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THE ORIGIN AND EVOLUTION OF THE HUMAN DENTITION

Quotations from the Preface of the Author's Book on This Subject, Recently Published for the Journal of Dental Research[1]

WILLIAM K. GREGORY

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The facts and interpretations of facts in the author's book are such as have presented themselves during the course of the author's palæontological studies at Columbia University and at the American Museum of Natural History, where since 1900 the author has had the inestimable privilege of close association with Professor Henry Fairfield Osborn.

As fully set forth in Professor Osborn's work on the Evolution of Mammalian Molar Teeth (1907), we owe to the late Professor E. D. Cope of Philadelphia the discovery (1883) that the "tritubercular type was ancestral to many if not all the higher types of molar teeth." "This," writes Professor Osborn, "is one of the most important generalizations ever made in mammalian comparative anatomy." He further says that in his opinion "the evidence in favor of it is so overwhelming that primitive trituberculy is no longer an hypothesis or a theory but an established fact." Similarly Doctor J. L. Wortman, author of a standard work on the Comparative Anatomy of the Teeth of the Vertebrata (1886), and the discoverer and describer of many important types of Eocene mammals, writes thus of Cope's theory of Trituberculy:[2]

"The broad generalization sought to be established by this theory is one of the most important and far reaching deductions within the whole range of mammalian morphology, and is a performance in every way worthy of

[1] The concluding section (V) of the book referred to was published on pages 87–228 of this volume (March issue). These quotations from the preface supplement and explain certain features of the comment in the previous publications by Dr. Gregory in this Journal, on "the origin and evolution of the human dentition." (W. J. G.)

[2] Wortman, J. L. Evolution of molar cusps in mammals. *American Journal of Physical Anthropology*, 1921, iv, pp, 177–188.

the great master mind that conceived it. It is one of the many enduring monuments that will stand to the credit of this greatest of all American morphologists as long as the science is cultivated.

"It is to be observed that Cope's theory of Trituberculy, as the name implies, sought only to reduce the highly developed and complex molar patterns to the basis of the simple three-cusped stage, and his researches and discoveries were largely to this end. These studies were mostly made upon the Amblypoda, Phenacodonts, Ungulates, Primates, Carnivores and related groups, and it is largely upon the molar evolution of these orders that the generalization rests. In this, Cope's researches have been epoch-making and it was almost wholly through these efforts that the evolution of the complex and complicated molar patterns of these forms was first completely understood. In the further development and elaboration of this subject, the researches of Cope have been powerfully supplemented by the work of Scott and Osborn, especially the latter, who has contributed greatly to our knowledge along these lines."

These statements by Professor Osborn and Doctor Wortman in support of Cope's generalization rest upon the broadest basis of fact. Since 1891 expeditions from the American Museum of Natural History have collected many thousand specimens of fossil mammals from a long and closely graded series of horizons in the Paleocene, Eocene and later formations of the West. These enormous collections, which are still being described in American Museum publications, afford cumulative evidence (which only those who know the material at first hand can fully appreciate) for Cope's and Osborn's conclusion that trigonal upper molars and "tuberculo-sectorial" lower molars are truly ancestral in pattern and may be traced along divergent lines into the more complex molars of various groups of carnivores, condylarths, perissodactyls, primates and other orders. Nor should we forget the reënforcement of this conclusion afforded by the great collections of European fossil mammals, as described during recent years by Depéret, Schlosser, Stehlin and many other palæontologists.

In 1895 Professor Osborn applied to the cusps of the human molars the system of nomenclature which he had invented at an earlier period for the molar patterns of Eocene mammals, replacing such cumbrous terms as anterior palatal, anterior buccal, etc., with the simple and easily remembered terms of protocone, paracone, meta-

cone, hypocone, for the cusps of the upper molars,[3] and protoconid, metaconid, hypoconid, entoconid and hypoconulid for those of the lower molars.[4] "When we understand," he continued, "that all the teeth of all mammals have this key, this tritubercular key, we can unlock the comparisons through the series and point out the homologies," a statement which, after certain reservations and restrictions have been made, is still, in the judgment of the writer, essentially true.

Unfortunately the numerous and fundamental contributions of Professors Cope and Osborn to the subject of the evolution of mammalian molar teeth, from the tritubercular type onward, are too often lost sight of as a result of the altogether disproportionate attention that has been devoted to the "Cope-Osborn hypothesis" of the origin of the tritubercular molar from the triconodont molar.[5] This "frail hypothesis," as the writer has called it (1916, p. 240), was that triangular molars had been derived from the triconodont type with three cusps in fore-and-aft line, by the migration, rotation, or circumduction, of the two marginal cusps, outward in the upper and inward in the lower jaw.

The Cope-Osborn hypothesis has been rejected, as insufficient or in conflict with other evidence, by several authors, including Dr. J. L. Wortman (1903–'04). Professor Osborn in 1907 (p. 8) restated the evidence in its favor and concluded, "there is thus evidence for cusp rotation, but it is not an essential part of the tritubercular theory, because, as above stated, the denticles (para- and metacones) may have arisen on the inner and outer sides of the crown from the outset."

[3] protocone = mesiolingual
paracone = mesiobuccal
metacone = distobuccal
hypocone = distolingual

[4] protoconid = mesiobuccal
paraconid (absent in man)
metaconid = mesiolingual
hypoconid = distobuccal
entoconid = distolingual
hypoconulid = distal

[5] Wortman (*loc. cit.*, p. 187) attributes to Osborn the authorship of this hypothesis; but Cope (in his Origin of the Fittest, p. 347) refers to it as his own, and Osborn has always (1888, p. 243; 1907, p. 4) given Cope the credit for it. It is clearly set forth in Cope's article on the Creodonta in the *American Naturalist*, 1884, p. 259. For full references here and beyond see the corresponding bibliography on page 218 of this volume.

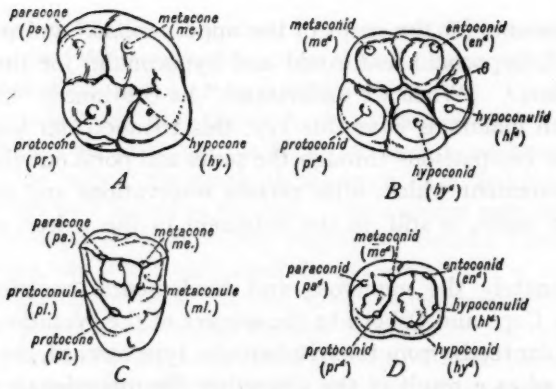

FIG. A. THE OSBORNIAN NOMENCLATURE OF THE MOLAR CUSPS

A.—Second left upper molar of man (Kaffir).

B.—Second left lower molar of man (Australian black).

C.—Second left upper molar of *Pelycodus trigonodus*, a lower Eocene lemuroid.

D.—Second left lower molar of the same species.

C and D represent the primitive, tritubercular upper molar and tuberculo-sectorial lower molar.

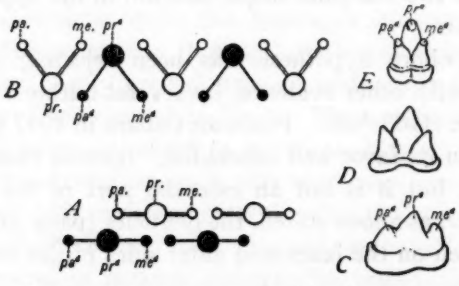

FIG. B. THE COPE-OSBORN HYPOTHESIS OF THE CIRCUMDUCTION OF THE PARA- AND METACONES

A.—Triconodont stage with all three cusps in the same antero-posterior plane, as represented by *Amphilestes* (C).

B.—Tritubercular stage with the two minor cusps circumducted to the outer side in the upper teeth (white) and to the inner side in the lower (black).

C.—A lower molar of *Amphilestes*, Jurassic, England.

D.—A lower molar of *Menacodon*, Jura-Cretaceous, Wyoming. Inner side showing the paraconid and metaconid partly displaced to the inner side of the crown.

E.—A lower molar of *Spalacotherium*, Jurassic, England. Paraconid and metaconid completely displaced to the inner side of the crown.

This hypothesis is applicable, if at all, only to the origin of the molar patterns of the Triconodonta and not to other orders of mammals.

In the present work (Part I) as well as in previous ones (1910, p. 193; 1916, p. 242–3), the author supports the view that in the remote ancestors of typical mammals the para- and metaconids of the lower molars probably arose, in situ, as up-growths from the cingulum, but that in *Spalacotherium*, *Menacodon* and their allies there may have been a migration or shifting of the para- and metaconids. The view of Cope and Osborn that the so-called protocone (mesio-lingual cusp) of typical upper molars represents the original apex of the crown, has been attacked by many authors, as set forth by Osborn (1907) and the present writer (1916).

Recognizing the cumulative weight of the evidence that in the upper molars of early Tertiary mammals the so-called protocone is not the oldest, or first cusp, but represents an upgrowth from the basal tubercle or cingulum [as maintained especially by Wortman (1903–'04), Gidley (1906), Matthew (1910), Gregory (1916)], and that the primitive tip of the reptilian crown lies in the paracone (or para + metacone), the author has formulated in the present work (Parts I, II, fig. 44) the following principles:

(1) That in the triangular upper molars of early Tertiary mammals there are two principal "trigons," (a) the *primary trigon*, consisting of the divided "original tip" (para + metacone) and the external cingulum, and (b) the *secondary trigon*, comprising the inwardly grown "protocone" and the divided original tip.

(2) That the homologue of the trigonid of the lower molars is not the *secondary* but the *primary* trigon.

It follows from these principles, and from studies of the occlusal relations of the upper and lower teeth, that Cope's conception of the origin of the tritubercular molar and, consequently, the whole nomenclature of the mammalian molars proposed by Professor Osborn, probably rest upon a misconception, by which the *secondary* trigon of the upper molar was viewed as corresponding with the *primary* trigonid of the lower molar.

But are we therefore to agree with Dr. Wortman (1903, 1921) and abandon the use of the Osbornian nomenclature? Gidley (1906), Matthew (1910) and the writer (1916) hold that as these names are far more widely used by palæontologists than any others, it is not likely that they will readily give up such a convenient system for

any of the cumbersome substitutes that have been proposed. Even although the "protocone" of the upper molars is probably not the oldest cusp of the mammalian molar crown, its name need not carry the implication of oldest, if used as a conventional name for that cusp. And even although the protocone of the upper molar has probably arisen with and is functionally analogous with the talonid, or posterior part of the lower molars (see Parts I, II), it would be in the highest degree confusing either to abandon the Osbornian nomenclature at this late date or to try to rectify it in accordance with the newer ideas. Such a compromise will no doubt be unacceptable to rigorous idealists who do not recognize that the terminology in question consists of more or less arbitrarily chosen symbols, which, although not always appropriate, have the merit of being well defined, practicable and in wide use.

For readers who desire to gain a preliminary idea of the contents of this work is suggested, first, an inspection of *figs. 346–353* inclusive,[6] illustrating the stages in the evolution of the human skull and dentition from fish to man, and secondly, a cursory review of the summaries and conclusions at the end of each part.[7]

It will be observed that the author contributes nothing new to the Piltdown problem, but leaves it *in statu quo*. While Part V[8] was in press, and since that time, Professor Osborn, Dr. Matthew and Professor J. H. McGregor have each examined the original Piltdown remains, and the later ones described (1917) by Smith Woodward. They have all come to the conclusion that the more recently discovered lower molar tooth is much like the original type, and that it lends strong evidence in favor of Smith Woodward's conclusion that the ape-like lower jaw belongs with the man-like skull. Professor Osborn also indorses Woodward's conclusion that the ape-like canine is a lower and not an upper one, and the same view is held by Dr. Milo Hellman, whose intimate knowledge of the occlusal surfaces of teeth lends weight to his opinion.

[6] Pages 216 and 217 of this volume.
[7] Volume II of this JOURNAL and no. 1 of this volume.
[8] No. 1 of this volume.

ANESTHESIA OF THE MIDDLE SUPERIOR DENTAL NERVE

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I. INTRODUCTION

This report summarizes investigations, conducted since 1915, relative to the possibility of amplifying the generally accepted technique of local anesthesia of the oral cavity, to include a simplified method for securing anesthesia of the maxillary bicuspids by the conduction method.

II. EVOLUTION OF ANESTHETIC PROCEDURES IN GENERAL USE

The manifold advantages of the nerve-blocking method, over such procedures as sub-periosteal and intra-osseous infiltration, are now too well recognized to require comment; and the early contentions of the writer on this subject (12, 13, 14) seem to have been justified. Conduction anesthesia has become the method of choice. This statement is made with a reservation respecting anesthesia of the middle superior dental nerve.

The technique employed to-day for the mandibular, the infra-orbital, and the maxillary tuberosity injections, evolved through application of the findings of Braun (1), Fischer (4), and others, is effective in securing anesthesia of the oral distributions of the fifth nerve in every region excepting that supplied by the middle superior branch of the second division.

Recently (1916) a technique was designed by the writer (12) which had for its object the anesthesia of this region by means of blocking the maxillary nerve in its entirety through injection into the spheno-maxillary fossa. Subsequently (1918, 1920) and seemingly independently, inasmuch as no authority was cited nor credit extended, Smith (9) and Nevin (6) described the same or a similar injection under similar titles.

The spheno-maxillary injection has been successfully if infrequently employed for upwards of five years, but its comparative difficulty has undoubtedly proved an obstacle to its universal application. For this reason a method has been sought that requires no unusual instrumentarium, and which is simple enough in detail to warrant its general employment.

III. HISTORY OF ATTEMPTS TO SIMPLIFY TECHNIQUE

In the course of his earlier research, the writer found it occasionally possible to reach the middle superior dental nerve through the standard infra-orbital injection, provided a large quantity of novocain was used (5 cc. or more) the excess of the solution apparently being forced far into the infra-orbital canal by the pressure of the distended soft tissues. As a sequence to this finding an examination of the maxillae in one hundred and eight skulls was made and these facts noted:

(*a*) The direction of the infra-orbital canal, extending medially and downwards from its origin opposite the spheno-maxillary fossa, to the foramen, was constant.

(*b*) Its orifice, the infra-orbital foramen, invariably opened medially and downwards.

(*c*) In one hundred and three skulls of this series, the canal was completely imbedded within the maxillary sinus, the five exceptions showing a loss of continuity of its roof, corresponding to the orbital floor, in one or both maxillae, at the posterior third.

An analysis of the descriptions of the middle superior dental nerve, given by Gray (5), Deaver (3), Sobotta (10), Piersol (7), Cunningham (2), Spalteholz (11) and Rauber (8), discloses a concurrence of opinion that it branches from the infra-orbital nerve at a point within the canal varying between 0.7 cm. and 2 cm. distal to the foramen.

On the basis of these findings, an effort was made, in 1917, to reach this filament via the infra-orbital canal, with a 3.5 cm. needle curved to an arc of 45°. By insertion into the labio-buccal tissue, at a point between the bicuspid teeth, it was found possible to insinuate the needle beyond the foramen and into the canal. An injection of 3 cc. of a 2 per cent novocain solution was found adequate to anesthetize the bicuspids; indeed in several instances the entire maxilla was

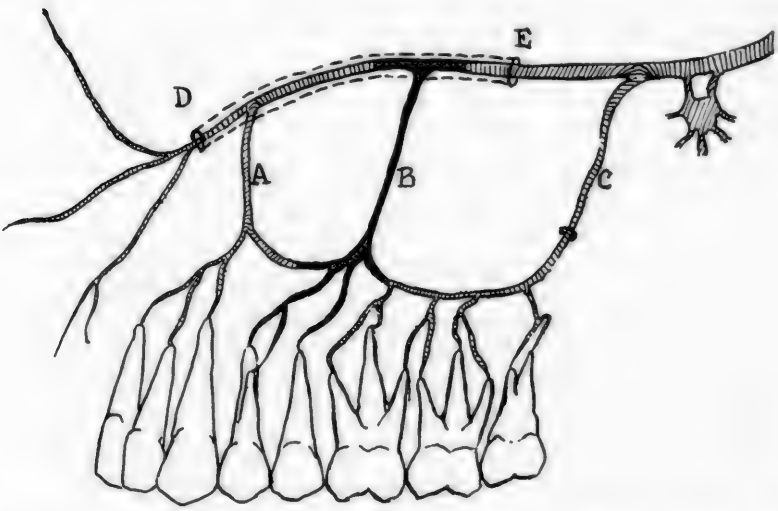

FIG. 1. SCHEMATIC REPRESENTATION OF THE MIDDLE SUPERIOR DENTAL NERVE, ITS ORIGIN AND SUPPLY

A.—Anterior superior dental nerve. *B.*—Middle superior dental nerve. *C.*—Posterior superior dental nerve. *D.*—Infra-orbital foramen. *D-E.*—Infra-orbital canal

included. The use of smaller quantities of solution produced unsatisfactory results. However, the difficulty of controlling and judging the path of the curved needle was recognized and the method rejected.

The conformity of these findings, with previous experiences in the injection of the maxillary nerve with alcohol for tic douloureux through an extra-oral approach, was noted. This procedure, as originally described by Matas, is in common use among neurologists (15). In his experience, the writer had found it possible to obtain anesthesia

of the entire maxillary nerve by advancing the needle point to a depth of not more than 1 cm. within the canal, and injecting 2 cc. of a cocainized 90 per cent solution of alcohol. This suggested an application of the same procedure in a series of five cases, substituting 2 per cent novocain-suprarenin solution for alcohol. Complete anesthesia of the maxilla, including the palate, was obtained in each instance.

The most reasonable deduction was that projection of the needle beyond the canal orifice to even a limited extent, forced the ejected solution into the canal to a considerable depth.

As a sequence to this thought, later attempts were made to enter the canal via the foramen, by making intra-oral insertions at points successively anterior to the bicuspid teeth. A proportional increase in the area of posterior tissues thus anesthetized was disclosed, the most inclusive zone of anesthesia resulting from insertions made at or close to the median line. The explanation for this, apparent upon duplicating the procedure in a dry skull, was that, by approaching the foramen from the median line, the needle had been inclined in a direction that permitted it to enter the canal for an appreciable distance.

In clinical application, it was found possible to secure invariably an anesthesia of the anterior and middle superior dental nerves by accurately directing the needle through the foramen by this approach. As a rule the anesthesia was even more extensive. The findings, with a tentative technique for a new injection designed to anesthetize the maxillary bicuspids, were early communicated to associates at Mt. Sinai Hospital and Columbia University, as a result of whose efforts the method was independently proved clinically. (This opportunity is taken to acknowledge the writer's indebtedness to Doctors S. Hemley and I. R. Levy for their valuable co-operation at this stage of the work.)

IV. DESCRIPTION OF TECHNIQUE

A method was eventually adopted that is uncomplicated by difficulties in approach, and which obviates passage through either muscles or blood-vessels. The exact location of the infra-orbital foramen is determined by external palpation, and its position identified through-

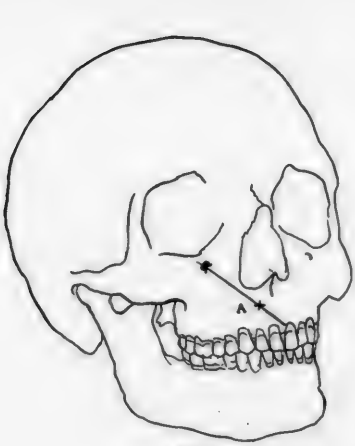

FIG. 2

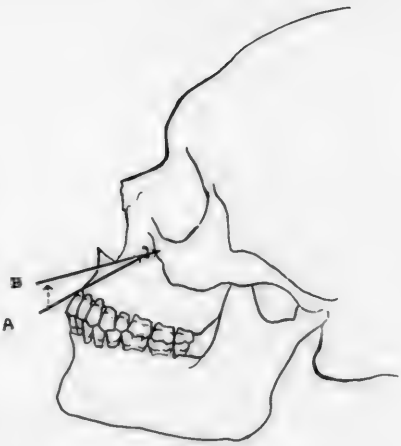

FIG. 3

FIG. 2. ANTERIOR VIEW OF SKULL SHOWING DIRECTION OF THE NEEDLE

A indicates the point of insertion

FIG. 3. LATERAL VIEW OF SKULL SHOWING RELATIONSHIPS OF THE NEEDLE

A.—Initial path of insertion. *B*.—Elevation of needle, after full insertion, to an angle that permits the needle to enter the canal.

FIG. 4. SECTION OF ANTERIOR-POSTERIOR ROENTGENOGRAM OF SKULL, SHOWING DIRECTION OF THE NEEDLE, AS IN FIGURE 2

out the procedure by the index finger of the left hand, the thumb remaining available for retraction of the lip. The mucosa above the apices of the central and lateral incisors is carefully dried and disinfected by means of Tr. iodine (U.S.P.). A 4-cm. needle is inserted into the labio-buccal fold at a point above the interproximal space of the central and lateral, its path of penetration being directed

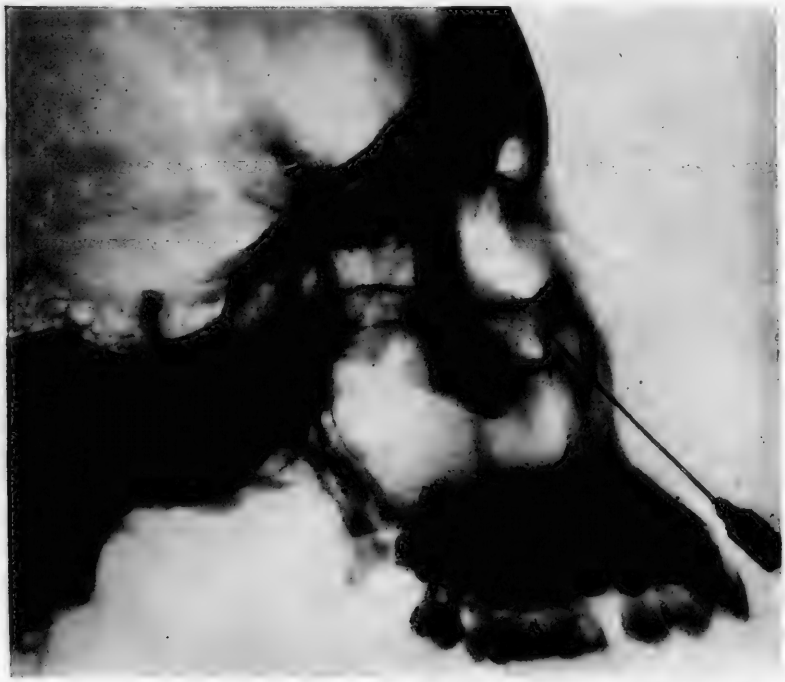

FIG. 5. SECTION OF LATERAL ROENTGENOGRAM OF SKULL, SHOWING INITIAL PATH OF INSERTION OF THE NEEDLE, AS IN FIGURE 3, *A*

posteriorly and upwards at an angle of approximately 45° with the incisal line, and parallel in an antero-posterior direction with the axis of the lateral incisor. This is accomplished by keeping the base of the needle as far as possible from contact with bone. In this manner only the soft tissues are traversed until bone is reached near the infra-orbital foramen. The arrival of the needle in that vicinity

is easily detected beneath the palpating index finger of the left hand, and, by elevating the syringe so as to incline the needle as nearly to a perpendicular with the surface of the maxilla as the tension of soft tissues will permit, the needle point may be accurately guided through the foramen and into the canal until further progress is impeded by

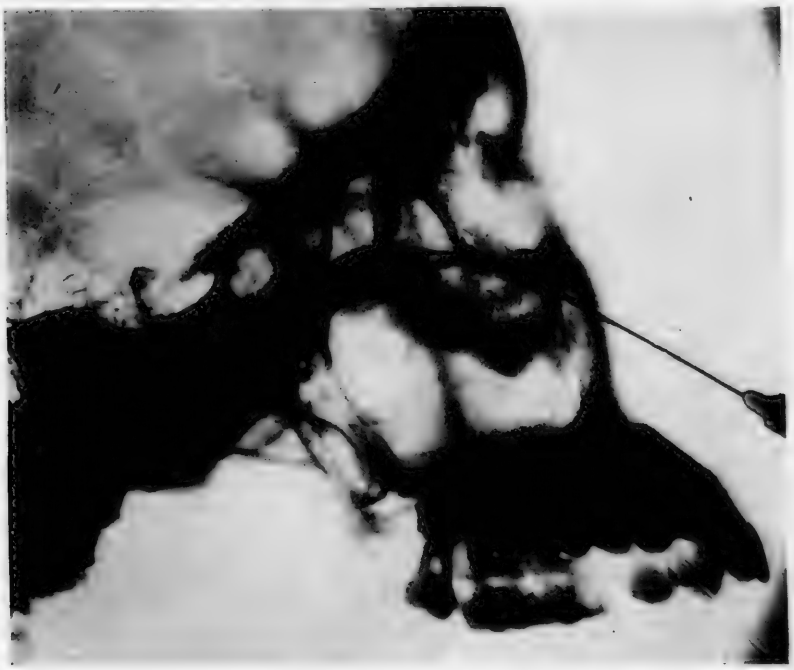

FIG. 6. SECTION OF LATERAL ROENTGENOGRAM OF SKULL, SHOWING ANGLE AT WHICH INSERTION OF THE NEEDLE IS COMPLETED, AS IN FIGURE 3, *B*

the roof of the canal, an average penetration of about 0.5 cm. Two cc. of 2 per cent novocain-suprarenin solution are very slowly injected.

Anesthesia of the maxillary tissues with the exception of the palatal mucosa, from the median line to and including the second bicuspid, follows almost immediately. After the lapse of ten minutes, the affected zone very frequently becomes more extensive, the entire maxilla including the palate being anesthetized in a large proportion

of cases. When such a result obtains, persistence of sensation in the mucous membrane covering the buccal alveolar process, in the region of the second and third molars, is occasionally observed. This is ascribable to an unusual but well known distribution of the long buccal nerve.

The deduction that suggests itself is that the novocain solution is forced through either the infra-orbital canal or beneath the perineurium of the nerve sheath or both, to a point as far centripetally in most cases as the spheno-maxillary fossa. *It invariably reaches the middle superior dental nerve.*

The anesthesia afforded by this method is quite as profound as that resulting from any known procedure, and is especially satisfactory for surgical explorations of the maxillary sinus.

The following tabulation represents the recorded results obtained by the writer in a series of 620 such injections performed during 1920–1921. The solution used in each case was 2 cc. of a 2 per cent novocain solution in distilled water and containing 0.001 milligram of suprarenin.

AREA ANESTHETIZED	NUMBER	PERCENTAGE
Maxilla, including palate	209	34
Maxilla, excluding palate	294	47
Incisors, bicuspids and first molar	316	51
Incisors and bicuspids	620	100

V. SUMMARY OF CONCLUSIONS

The middle superior dental nerve may be anesthetized by the injection of a novocain-suprarenin solution directly into the infra-orbital canal via the foramen.

This may be accomplished by projecting the needle from a point near the median line to and through the infra-orbital foramen.

The resultant anesthesia is in no way inferior to that produced by any other method.

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RESULTS OF FIVE YEARS OF DENTAL PROPHYLAXIS FOR EMPLOYEES OF THE METROPOLITAN LIFE INSURANCE COMPANY[1]

THADDEUS P. HYATT

New York City

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I. INTRODUCTION

"The greatest sanitary reform in the world lies in the task of revolutionizing the unsanitary and infectious condition of the human mouth."—*D. D. Smith.*

"There is not one single thing more important to the public in the whole range of hygiene, than the hygiene of the mouth."—*William Osler.*

Doctors Gies and Kligler of Columbia University have shown that, by weight and count, the number of bacteria per milligram of tooth scrapings in a dirty mouth is about eight hundred millions as compared with only five millions in a fairly clean mouth.

While it is true that bacteria will always be present in every mouth, clean or dirty, may not bacteria in a clean mouth be practically harmless? Owing to the condition of a dirty mouth, containing food debris, and presenting inflamed gums with their exudations, may not the bacteria in such a mouth become virulent and dangerous, particularly when absorbed into the blood and lymphatics from pockets around the teeth. Even slight inflammation of the gums often permits the conveyance of bacteria into the pulp of a tooth, thus bringing about susceptibility to dental caries. In unclean mouths are always found inflamed gums, and the gingival borders present an area eight times greater than that of the crypts of the tonsils.

[1] Read at a meeting of the American Academy of Periodontology, New York City, May 9, 1921.

Two important factors in life are food-energy and man-power. The conversion of food-energy into man-power depends very largely on mouth conditions. If food-energy is to be successfully converted into efficient man-power, the machinery necessary for its conversion must be kept in a sanitary and hygienic condition. It is evident, therefore, that all health work should start at the mouth. It is needless to point out the fact that all foods must lose much of their nutritive value when taken into unclean mouths.

That more attention has not been given to this phase of health work is probably due to the fact that data have not been available to show the actual hygienic results obtainable through mouth cleanliness by means of regular and periodic prophylactic treatments.

II. THE AUTHOR'S FINDINGS

During the past five years thousands of the employees of the Metropolitan Life Insurance Company have received two prophylactic treatments each year. Careful records have been made of mouth conditions. Degree of cleanliness of the mouth has been indicated by "yes," "no," or "fair." Cases classified under "no" are those which show *considerable* deposits of tartar, with inflammation of gum tissues. Those classified as "fair" have *slight* deposits of tartar and slight gum inflammation, while those classified under "yes" are *practically free* from tartar or gingivitis. This classification was made solely from the view-point of hygiene or whether the patient's health might be affected by mouth conditions. Therefore, the mouths of those classified under "yes" were not *perfectly* clean. Stains either from tobacco or other causes might have been present but they were not believed to influence the health condition of the mouth nor of the patient. *Data* secured under these classifications should prove of value and of interest.

All employees who first came to the Dental Division in 1915, and who have continued to come twice each year, are called Class 1; those who first came in 1916 are called Class 2; those in 1917, Class 3; in 1918, Class 4; in 1919, Class 5; and in 1920, Class 6.

In 1918 we first ascertained the percentages respectively for "yes," "no," and "fair," for the four classes we had at that time. The data in that first summary are appended:

	YES	NO	FAIR
	per cent	*per cent*	*per cent*
Class 1, started in 1915	27	25	48
Class 2, started in 1916	25	27	48
Class 3, started in 1917	18	29	53
Class 4, started in 1918	10	50	40

These figures show that, in Class 1, 27 per cent were "yes;" in Class 2, 25 per cent; in Class 3, 18 per cent; and in Class 4; only 10 per cent. The class that had been coming regularly twice each year for the longest period showed the highest percentage of "yes," and the remaining classes showed corresponding standings according to the length of time they had received the treatments.

It is interesting to note that the youngest class at that time (Class 4) showed 50 per cent under "no," while Class 1 showed only 25 per cent under "no."

Similar data were again compiled two years later, with the results shown below:

CLASS	YES			NO			FAIR		
	1918	1919	1920	1918	1919	1920	1918	1919	1920
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
Class 1, started in 1915	27	33	39	25	9	6	48	58	55
Class 2, started in 1916	25	33	43	27	9	7	48	58	50
Class 3, started in 1917	18	35	42	39	9	6	53	56	52
Class 4, started in 1918	10	27	40	50	14	9	40	59	51
Class 5, started in 1919		21	33		27	12		52	55
Class 6, started in 1920			13			31			56

In examining this table, we notice the interesting fact that Class 1, in 1918, showed 27 per cent under "yes," and that this value increased to 33 per cent in 1919, and to 39 per cent in 1920. We also observe that, in 1918, Class 1 had 25 per cent under "no" and that this value was reduced to 9 per cent in 1919 and to 6 per cent in 1920. In Class 2, we find the same marked improvement. In 1918, 25

per cent of this class had "yes" mouths. This value was increased to 33 per cent in 1919, and to 43 per cent in 1920. Studying this class under the heading "no," we find that in 1918 there was 27 per cent, which was reduced to 9 per cent in 1919 and to 7 per cent in 1920. Similar improvement was shown by each of the different classes. The figures under "fair," show an interesting fact. In 1919, Class 1 had 58 per cent "fair." In 1920, this was reduced to 55 per cent—a loss of 3 per cent. There is also a reduction under the heading "no;" in 1919 there was 9 per cent and in 1920, 6 per cent—a loss of 3 per cent. This makes a total loss of 6 per cent under "no" and "fair." The figures under "yes" show that there was an increase of 6 per cent from 1919 to 1920. This indicates that 3 per-cent was transferred from "no" to "yes," and 3 per cent from "fair" to "yes;" or, of course, that the entire 6 per cent change shifted from "fair" to "yes," and 3 per cent from "no" to "fair."

For Class 2, 58 per cent were "fair" in 1919 and only 50 per cent in 1920. For "no," this class had 9 per cent in 1919 and 7 per cent in 1920. This makes a total shift of 10 per cent for these two classes. This is accounted for under "yes," for the increase under "yes" goes from 33 per cent in 1919 to 43 per cent in 1920, a total of 10 per cent.

The improvement in Class 1 (from 1918 to 1919) is indicated by a gain from 6 per cent under "yes," a gain of 10 per cent under "fair," a total of 16 per cent. There is a corresponding loss of 16 per cent under "no."

It is also interesting to note that each of the first four classes showed an increased per cent under "fair" between 1918 and 1919, but a loss between 1919 and 1920. In every case, however, the gain under "yes" equals the loss under "no." Class 5 also showed an increase under "fair" for its first two years. It will be interesting to observe whether, in its third year, it will respond to the same way as have the first four classes.

The foregoing data, secured from over 26,000 cleansing operations, should be sufficient to prove to all health workers the importance of first establishing clean mouths, particularly when we bear in mind the findings of Gies and Kligler regarding the large increase of bacteria in unclean mouths.

III. FURTHER DEVELOPMENT OF THE RESEARCH

The foregoing data have proved of such interest to our staff, that this year we are arranging a new method of classification in a continuance of the study. The new classification is indicated by the items in the appended summary, in which dental conditions are divided into five types from our point of view.

(1) Excellent: no stain and no tartar.
(2) Good: nicotine stain, but no tartar.
(3) Fair: some stain and little tartar.
(4) Poor: unclean mouth, with stain and considerable tartar.
(5) Bad: dirty mouth, with heavy deposit of tartar.

Gum conditions will be classified as (1) normal, (2) slightly inflamed, (3) inflamed, (4) badly inflamed, and (5) badly inflamed, with pus.

We believe this classification will enable us to secure data of even more value and interest than those already secured.

The question of the beneficial effects obtained by the regular use of lime water is being given consideration, and steps have been taken to tabulate this information. It is desirable to consider only the individuals who use lime water regularly and for considerable periods of time. It is somewhat difficult to find patients who will perform any of their dental duties with regularity, and the only figures that may prove of value in this connection are those showing changes in mouth conditions, including gums and teeth, and also reductions, if any, in the number of cavities per patient.

Metropolitan Life Insurance Company.

PRESENT-DAY DENTAL PHYSIOLOGY[1]

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I. QUESTIONNAIRE

In preparing this review relative to the teaching of dental physiology, my starting point was the following questionnaire, sent, over a year ago, to the heads of the departments of physiology in the dental schools that were then members of the Dental Faculties Association of American Universities, namely, those in the University of California, Harvard University, University of Illinois, University of Iowa, University of Michigan, University of Minnesota, University of Nebraska, Ohio State University, University of Pennsylvania, Tufts College, and Washington University:

"The Dental Faculties Association of American Universities is preparing a syllabus as to what shall constitute a standard dental curriculum, and the writer has been requested to formulate an outline for a complete course in dental physiology which will be presented at their January meeting (1921).

"The compiling of such an outline would only be of small value without your coöperation and I am taking the liberty of asking you to express your views as to the teaching of dental physiology so that they may be incorporated in the forthcoming report. Your views will be especially helpful regarding the following:

"Kindly indicate the number of hours and subjects covered by you in (*a*) lectures, (*b*) recitations, (*c*) quizzes, (*d*) demonstrations, (*e*) laboratory work (grouping of students).

"Where, in your opinion, should the course in dental physiology be in the dental curriculum and what courses should precede it?

[1] Reported to the Dental Faculties Association of American Universities, by Dr. William Rice, Dean of Tufts College Dental School, January 23, 1921, at Indianapolis, Indiana.

"While I fully realize that replying to the above will be an additional hardship, I feel that the final completion will be worth the time we devote to it."

II. REPLIES TO THE QUESTIONNAIRE

Replies were received from Harvard University and the universities of Illinois, Iowa, Minnesota, and Pennsylvania. These replies formed the basis of this paper. It is to be regretted that more replies were not received and that those received did not indicate the subjects covered. These facts necessitate that my original intent to write a syllabus on the teaching of dental physiology be modified for the present to a discussion of some phases of present day teaching. It it my belief, especially in view of the wide diversity of opinions pertaining to the teaching of dental physiology, that the desired syllabus can better be compiled by a committee of three prominent physiologists.

If reference is made to the questionnaire, it will be noted that (*a*) an expression is asked for regarding the teaching of dental physiology. (*b*) The number of hours and subjects taught is called for. (*c*) Information as to the ideal location of the course in physiology in the dental curriculum is sought, as well as to the subjects which should precede it.

(a) Regarding (*a*), Professor McClintock of Iowa writes as follows, basing his reply upon the supposition that the dental course is extended over a period of four years and is preceded by at least one year of liberal arts. "The liberal arts course is to include general chemistry, biology and probably also physics. In preparing a standard dental curriculum I think the above trend, and in many cases the already adopted plan, should form the basis upon which the prospective curriculum should be constructed."

Professor F. H. Scott, of the University of Minnesota, writes: "I think the number of hours for physiology for dental students should be increased slightly or else the students should come to us a little better prepared to study physiology. In this respect the later classes are improved over what they were a few years ago."

(*b*) To the inquiry pertaining to the length of time given to dental physiology in the several schools of this association (*b*), came replies which are indicated in table 1.

It will be noted at once that one school (Harvard) gives a minimum of 200 hours, while the course in the University of Minnesota school is completed in 126 hours: the other schools ranging between these two extremes.

A further striking feature is the fact that in two schools, namely, those of the University of Iowa and the University of Pennsylvania, the dental students receive no training in physiological laboratory

TABLE 1

Data pertaining to the number of hours given to dental physiology

	HARVARD	ILLINOIS	IOWA	MINNESOTA	PENNSYLVANIA	TUFTS
Lectures.....	55–60	128	88	36	132	100
Recitations	12	(1)[1]	(1)	Not stated	None	(1)
Quizzes.....	3(3)[3]	(1)	32	12	None	(1)
Demonstrations	10–15	(2)[2]	24	12	64	15
Laboratory	120	96	None	36	None	70
Total number of hours.....	200–210	224	144	126	196	185
Time factor.....	12 weeks	32 weeks	Not stated	12 weeks	Not stated	16 weeks

[1] (1): Signifies portions of lecture hours.
[2] (2): Signifies portions of laboratory hours.
[3] (3): Signifies monthly written quizzes.

work. In regard to this Professor McClintock of the University of Iowa writes:

"I am not favorable to putting in laboratory courses for students. The loss of time in having the student obtain even a fair physiologic technique is much too great in comparison to the additional physiological knowledge which he might receive from doing the experiments himself. I am, therefore, using laboratory demonstrations entirely in the dental course and am also introducing an increasing number for my medical classes. When such demonstrations are given to small sections, more of the important physiological factors in an individual experiment can be brought out, as well as making it possible, in a small number of hours, to present a greater variety of experimental work."

All teachers of physiology and of experimental pharmacology have experienced from time to time this feeling expressed by Dr. McClintock. On the other hand, the writer believes that, especially with the dental students, there is much to be gained aside from the actual

outcome of the laboratory experiments performed. It is my opinion that the dental student will acquire in the physiological laboratory a considerable amount of skill and technique from preparing such delicate structures as the classical muscle-nerve preparation: and that the exactness and patience required in obtaining the desired results will be an asset in his future practice of dentistry.

Dr. Stiles of Harvard, in speaking of final examinations, has made it a practice to require students to perform "three experiments drawn by lot from forty or fifty previously posted, in addition to a written test of two hours. The practical has a weight of forty, the written sixty." This points out the value of laboratory physiology, in relation to didactic physiology, held by the authorities at Harvard

Statistics show that the leading teachers of medical physiology devote approximately fifty percent of their time to the laboratory classes Regarding dental physiology, the above table shows that in those schools where laboratory work is offered, approximately the same ratio is adhered to. In my opinion it would be an injustice to attempt to regulate the division between didactic and laboratory teaching. This should be left to the discretion of the qualified teacher of physiology.

(The better equipped dental student should be offered opportunities for further work along the lines of his greatest interest. This should be made possible in all departments and would allow such students to develop more fully their special abilities The required dental curriculum should be elastic enough to make this feasible.)

The data in Table 1 clearly show, also, that the recitation method of teaching dental physiology is weak. I cannot point to the value of this method better than by quoting from the Report of the Committee of One Hundred on a Standard Curriculum for Medical Colleges, section F, page 5:

"Regarding didactic teaching, several committee-men speak highly of recitations as a means of (1) keeping the students constantly up on their work, (2) of compelling them to read a text book, (3) of conveniently grading them, and (4) of correcting errors into which they may have fallen. Some would give one recitation for each two lectures. Others are not so explicit as to the numerical relations but speak favorably of the recitation as a means of instruction, as compared with lectures."

I am frank to confess that I myself am in the same category as the gentlemen who made the above recommendation and that, while I realize the better balance which the recitation system would probably give to the course in physiology, I have not so far emphasized this method at Tufts.

Table 1 points to the fact that dental physiology is now being taught in some schools throughout the college year, while in other schools the course is highly concentrated, being completed in about twelve weeks. I believe it is the growing opinion among medical teachers that the concentration plan is the better, because it immerses the student in the subject and surrounds him with a physiological

TABLE 2

Data on the nature of the courses that should precede dental physiology

	HARVARD	ILLINOIS	IOWA	MINNESOTA	PENNSYLVANIA	TUFTS
Anatomy	Yes	Yes	Yes	(1)[1]	(1)	Yes
Histology	Yes	Yes	Yes	(1)	(1)	Yes
Chemistry:						
General	Yes	Yes	Yes	Yes	(1)	Yes
Organic	Yes	Yes	Yes	Yes	(1)	Yes
Physiological	(2)	Yes	Yes	(2)[2]	(1)	(2)

[1] (1): Not stated.

[2] (2): Physiological chemistry given simultaneously with physiology.

atmosphere quite impossible to acquire when the course is spread over the full college year. Of course this arrangement depends upon the size of the departmental staff; and it has the added value that, by this rather rapid completion, it leaves the staff comparative freedom for research work.

(*c*) Opinions as to the subjects that should precede physiology (*c*) are given in table 2, which indicate rather conclusively that the dental student should have anatomy, histology, and chemistry behind him before undertaking physiology. The subject of physiological chemistry, on account of its close interrelationship with physiology, can well be scheduled to run hand in hand with physiology. Such an arrangement is now in vogue at Harvard, Minnesota, and Tufts.

Dr. Dreyer, of the University of Illinois, calls attention to the fact that it is most desirable that the course in physiology be completed before pathology is begun. This is an important point and certainly should be insisted upon.

In conclusion I wish to call attention to an interesting paragraph of Dr. F. H. Scott's letter:

"While it is a matter that primarily does not concern physiology in particular, yet I think if you are revising the dental curriculum you would probably get some very interesting ideas on the curriculum if you got the general practitioner's point of view. By this I mean men not connected with the teaching of dental students in any way but engaged in the practice of dentistry. If you got the deans of a few dental colleges to give you the names of some of the prominent graduates of various places and asked them about the curriculum, I think the data would be well worth considering."

NECESSITY FOR REMOVAL OF ALL BROKEN-OFF ROOT TIPS[1]

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In view of the volume of clinical evidence that focal infection at root ends of teeth is the cause of a large proportion of physical ailments, it is exceedingly important that the greatest care be exercised, in the removal of teeth, that no root tips or particles of teeth be allowed to remain in the alveolus. It has been and is the opinion of some dentists that a fractured root tip, especially of a vital tooth, if left in the alveolus, is harmless. The patient is told, and the dentist satisfies his conscience with the idea, that the root tip will work or slough out, or be absorbed. It is reported on reliable authority that in one of our accredited dental colleges a recent senior class was taught, in both the surgical clinic and the lecture room, that, should root tips be broken off, it is not necessary to remove them—that they are absorbed with the process. Such teaching is deplorable.

It is doubtless a common weakness to be reluctant to tell patients, when root tips have been broken off, that such is the case for fear that they may think us unskilled or incompetent, and that they may resent the necessity for or object to the ordeal of further operation. Both operator and patient should face the issue in such cases—"*that tip should be removed!*" The x-ray has revealed the fact that such tips and fragments of teeth, if left in the alveolus, usually remain there indefinitely and become infected, and sometimes suppurative, whether the tooth when extracted was vital or non-vital.

All extracted teeth should be carefully examined. It is most exasperating to find a tip missing. The temptation is great to conceal the tooth and say nothing about it to the patient. Why not explain to the patient that fracture is often unavoidable and urge the necessity for completing the operation?

[1] Presented at a meeting of the American Society of Oral Surgeons and Exodontists, Milwaukee, Wisconsin, August 11, 1921.

The general public has been led to believe that tooth extraction is a simple procedure. It has not been many years since extraction was a side line for the barber or blacksmith, or at best the country doctor. The dentist of today is partially responsible for the public estimate of this service, because of the ridiculously small fee that is commonly charged for extracting teeth. Certainly there is much to be done in the way of educating our patients and the general public regarding the high degree of skill required successfully and acceptably to remove teeth under all the varied adverse conditions. Many teeth are brittle from devitalization that occurred a long time before, or fragile from decay or from the reaming out of the root canals for the insertion of posts. Some are hypercementosed or have pronounced curves near the apices. Some roots of teeth do not taper but have parallel sides and are very adherent to the adjacent bone. Removal without fracture of such teeth, when seated in heavy or densely calcified bone, is frequently a mechanical impossibility unless the way is prepared by careful dissection.

Why, then, should we hesitate to explain these facts to patients? Why should we try or pretend to measure up to their erroneous idea of tooth extraction? It is not required of us to remove all teeth instantaneously, or in one minute, or in any other specified time. Patients who are properly informed will appreciate our efforts to give them the best service when we remove all broken-off root tips, and dentists will be spared the blame for the consequences of leaving such fragments in place.

(The author then illustrated, with lantern slides made from radiograms of patients treated in his office, some of the many serious effects that resulted from retention of root tips in the alveolus, after incomplete extraction of teeth.—*Ed.*)

COMMERCIALIZED DENTAL EDUCATION[1]

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Cardinal Newman, once being asked what led men to become religious revolters, answered: "their impatience." The present status of dental education is as yet weakly heresied by the vain exhortations of the few whose mental mirrors throw off the image of that reply. All of which is another story.

The official christening of American dentistry, at Baltimore in 1839, was modestly attended. Our autobiography, as yet a small volume, informs the reader that up to that time our curative forbears, mater and pater medicus, considered themselves well enough advanced in years (centuries) to attend, with complete parentl authority, to the ills of man. In fact they were shocked even to think of a new protégé named "Dentistry," and all dental proclivities were at that period carried on to the tune of "that barber-shop chord." However, the seemingly impossible did occur, thanks to the efforts of two pioneer dental educators, Hayden and Harris; and presto, the offspring now past its eighty-second year! Indeed, no one can deny that, like the boy on the train who tries to make himself look small, ours is a large child for its age.

If the lines that follow induce a feeling of ennui, their excuse is the fact that they were written because of concern for the future and not that we cannot proudly point to many valuable achievements in our career thus far. Some may call this protest the "muck-raking" of a trouble-maker; but let it be recorded as an humble effort to focus a search-light upon facts, the whole attempt being constructively planned to accelerate the advancement of our beloved calling, the majority of whose members, with but relatively slight remuneration, aim sincerely to aid and better serve mankind.

[1] This paper is a brief report upon the results of ten years of careful study and observation in the field of dental education. It is founded wholly on facts, and is written with as much conservative dignity as the author's modest ability permits.

The dental profession of today is menaced by a great danger, namely, *commercialized education*, which, imbedded in money greed, rotten with inefficiency, bankrupt in great teachers, steeped in self-appointed authorities, and lacking in examples of spiritual leadership, infects the hand that feeds it.

Commercialized education may be defined as that form of educational *business* in which financial profit is considered either partly or wholly the fundamental object of its existence.

The reasons are cogent why attempts to place our profession on a dignified and scientific basis have, in the past, proved only partly successful. A cynical attitude on the part of the medical profession toward the idea of dentistry as an independent and learned profession, coupled with the mechanical atmosphere with which it was first dominated; insufficient numbers of interested men (the female factor was negligible), due to the comparative youth of their calling and the newness of dentistry as a distinct field; lack of fraternal sympathy due to jealousies, vanities and secrecies; segregated geographical distribution, with limited facilities for travel and association; scarcity of important dental literature; absence of proper medical standards which could be used as models, reflected in the preceptor system—all contributed to conditions that have prevented the broad establishment of systematized and scientifically directed dental education.

The result is seen in every part of the country. Lacking sufficient idealistic stimuli necessary for the proper establishment of any great learning, one of the consequences was commercialism. Money could and can be made even in teaching dentistry; and not only has this been done in the past but, sad to say, such a condition continues to be recognized to a considerable degree by the good-natured but mischievous tolerance exhibited by our profession.

A substantial number of our undergraduate dental schools are commercial in character, that is, they are conducted in the form of a corporately controlled educational *business* and comparatively few are of the best type. Today, as we scan the report of an attempt at standardization for the improvement of dental education, we readily note that these commercial schools, in spite of their numerical influence, are mostly reported as only fair or poor; and, corroborated by the experience of their students, they stand convicted of lacking

those requirements which, modeled from the standards of our finest medical schools, make for the best education of dentists. Ensconced by a lackadaisical guardianship, carried out after a fashion, dental education has been largely in charge of incompetent institutions.

Let it here be said in all fairness, particularly by those of us who are their products, that, judging from *past* standards, these schools have, generally speaking, done their best; and whatever good has been done for those who have passed through their doors must, with the bad, be fully accredited to them. But this is a new age. In spite of all good intentions, wholesome as they may be, when money-making is either partly or wholly a necessary object or ultimate purpose of any institution of learning, something must be wrong in its administration or ideals, or both, for commercialism and education make a poor combination.

There are those who will say that the world moves slowly and improvement in dental education, as in other spheres, takes time. Yes; but what advantages are there in this morose attitude toward commercialized education from the standpoint of the public we serve, of the profession itself, or of the student of dentistry? Should such a condition be permitted to continue?

There are two noticeable deficiencies in the poorly educated dentist of today. One is a lack of scientific concept and knowledge, as manifested by a persistence of the purely mechanical outlook. The other is a scarcity of public-spirited endeavor, as seen in the slouchy attitude toward high professional ideals concomitant with a failure to be imbued with what may be termed the spirit of public service as carried out by the medical fraternity. While it may be claimed that such deficiencies are partly attributable to the individual irrespective of his educational source, the writer contends that the major cause is the lack of professional idealism that never was, and never will be, imbued within the portals of *commercialized* dental schools.

What is the remedy? Complete abolition of commercialized dental education. Indeed, even the philanthropically endowed institutions are not conducive to the most wholesome interests of education. The state, representing all the people through the state university, should control and conduct dental education. The evil of money-making by commercialized dental schools, and the ignominy of money-

begging by philanthropic institutions with a consequent loss of academic independence, go hand in hand. However, the first step toward progress is the absorption of the dental educational *business*. Even the publicly endowed or eastern type of university school would be and is some improvement upon the older commercial type. But the main tendency in this country is toward direct state control of education. While the writer is not an advocate of all socialistic doctrines, he nevertheless strongly urges the practical adoption of complete state administration and direction of education, more particularly in relation to the teaching of dentistry.

Such a system was first carried out in several western states, where all professional schools except those of theology are under state control.

"State universities are the vitalized expression of popular sovereignty, thinking the highest thought in education and cultural organization. They touch the finer life of the commonwealth at every point, and represent the conviction that the state is bound as a condition of its safety and perpetuity to provide from its own resources both a sound and well-adapted general education for all its citizens, and a higher and more exacting discipline for those who are to be its leaders and inspirers."[2] Except in some schools which make separate provision for negroes, there is no distinction as to race, color, creed or social class. They are linked in a general educational scheme and coöperate with the public-spirited interests of the state. "The state university is already the peer of the older foundation, whether measured by resources, student registration, scholarly standards, or public confidence in its integrity and leadership."[2]

Among the states whose official state-supported universities conduct dental schools of the best or "class A" standing are California, Illinois, Iowa, Michigan, and Minnesota.

Our profession should not alone advocate the highest type of undergraduate education, but should urge the adoption of state laws which would make it legally impossible for any but graduates of "class A" schools, after sufficient time for readjustment is allowed, to be admitted to practice. Incidentally another prospective reform is the

[2] Babcock: Cyclopedia of Education (Monroe). 1913, v, p. 673. (Macmillan Co., N. Y.)

establishment of a single Federal examining board to take the place of the multitudinous state bodies, with interstate privileges to those who successfully meet its requirements. Such a body has already been established for medicine and is recognized by several states.

If the dentist of the future is to be decently educated, we must first establish means for the decent education of the future dentist.

110 East 54th Street

SCIENTIFIC PROCEEDINGS

OF

DENTAL AND STOMATOLOGICAL SOCIETIES

A LIST OF THE NAMES OF THE ORGANIZATIONS THAT HAVE VOTED TO MAKE THE JOURNAL OF DENTAL RESEARCH THE MEDIUM FOR THE OFFICIAL PUBLICATION OF THEIR SCIENTIFIC PROCEEDINGS

(December, 1921)

Association of the Allied Dental Societies, Inc.

American Academy of Dental Science

Massachusetts Dental Society

Harvard Odontological Society

Boston and Tufts Dental Alumni Association

First District Dental Society of the State of New York

Metropolitan District of the Massachusetts Dental Society

Harriet Newell Lowell Society for Dental Research, of the Harvard University Dental School

San Francisco Society for Dental Research

Colorado Society of Periodontists

American Academy of Periodontology

New England Society for the Promotion of Dental Research

American Society of Oral Surgeons and Exodontists

William Jarvie Society for Dental Research, of the School of Dentistry of Columbia University

Columbia University Biochemical Association

In the case of the last named organization, only the dental and stomatological parts of its proceedings will be published in this Journal.

A standing general invitation is extended to dental and stomatological societies, everywhere, to add their names to the above register.

SCIENTIFIC PROCEEDINGS OF DENTAL AND STOMATOLOGICAL SOCIETIES

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PROCEEDINGS OF THE FIRST DISTRICT DENTAL SOCIETY OF THE STATE OF NEW YORK[1]

S. E. DAVENPORT, JR., *Editor*

Meeting held February 7, 1921. Academy of Medicine, New York City. President Leland Barrett in the chair.

Scientific proceedings. Papers by M. M. Bluhm, D.D.S., New York City, on "*preventive dentistry in the public school system*" (this page), and E. Briggs Riblet, D.D.S., New York City, on "*the public health problem*" (page cx). *Discussion* by Commissioners Royal S. Copeland and Bird S. Coler, Mr. Arthur T. Gorton, Drs. Maurice S. Calman, Wm. D. Tracy, and Louise C. Ball, of New York City; and Drs. Bluhm and Riblet (page cxv).

PREVENTIVE DENTISTRY IN THE PUBLIC SCHOOL SYSTEM

M. M. BLUHM

In a paper read before the Dental Society of the State of New York, at Syracuse on June 14, 1919, Dr. Hermann Prinz said: "We do not want to extract every tooth that has a dead pulp in it—it will be a sad day for dentistry when that time comes." In a paper read before the First District Dental Society of the State of New York, on November 3, 1919, Dr. W. D. Tracy said;[2] "A statement has issued forth from a western city that the dentists there no longer fill root canals. . . . . If final, authentic, scientific proof can be given to the dental profession that the treatment and filling of the canals of pulpless teeth, when done according to what we call modern aseptic methods, is vicious and unwarranted practice, the ensuing demonstration of joy among the dentists would make

[1] Manuscripts of the papers read at the meetings held on October 4 and November 1, 1920, have not yet been presented for publication.—(S. E. D., Jr.)

None of the papers read at meetings in the year 1921, except those in this issue, has been presented for publication.—(W. J. G.)

[2] Tracy: JOURNAL OF DENTAL RESEARCH, 1919, i; proceedings, p. cxxi.

our memorable armistice-day celebration resemble a children's May party by comparison. How sublimely simple and easy would the pursuit of general practice become if we were to abandon root-canal filling and to send all cases of pulp lesion of every type to that gentleman of rapidly increasing prestige, the exodontist."

It would appear, then, that the rapid approach of the "sad day for dentistry" *may* be turned into a day of "demonstration of joy" if a plan can be adopted whereby the amount of root-canal work can be at least greatly diminished in dental practice, by the retention of the vitality of nearly all pulps, beginning with the teeth in childhood. Why need there exist in adult life such a vast number of non-vital teeth calling for root-canal treatment?

In the early days of dentistry most operators extracted all teeth involving the pulp, and were subsequently condemned for their so-called barbarous practice. Somewhat later dentists took to the filling of root canals with numerous types of Iodoform preparations. These men were likewise condemned as a result of the development of roentgenography in dentistry, but the practice is still faithfully adhered to by a vast number in our profession. We then passed on to the aseptic root-canal procedure but, even after all these years of effort and research, much of the work is being condemned to the forceps, and the profession drifts along. This remark does not apply to any great extent, of course, to the highly trained root-canal specialists, for their work is more thoroughly performed because of their exceptional skill and the fact that they devote numberless hours to the work. The fact remains, however, that these few operators can give their service to only a relatively wealthy class of patients, thus excluding the average patient from receiving the benefits of the best attention in this regard. It follows, therefore, that in the average dental practice, regardless of the technique followed, root-canal work in its final analysis must be regarded, at best, as "doubtful dentistry."

The dentist of the future will be required, perhaps, to begin in the public-school clinic and to conserve the first molars; so that, when patients who have received such early treatment visit the offices of dentists in subsequent years, vitality of the pulps will be assured, and more permanent and better dentistry can be readily applied to the same vital teeth. Furthermore, future dental work will consist of operative technique, applied *almost* exclusively to vital teeth, that will require of every dentist extreme caution never to involve the pulp, except possibly through accident or from absolute necessity, for in time the public will be educated to the fact that the loss of a pulp is a serious personal matter. Thus, with root-canal work reduced

to a minimum quantity, what there will be of it can be referred to the specialist.

How can this change in routine dental practice be brought about? Through the establishment of a dental clinic in every public school as a part of the school system, each clinic to be in charge of a dentist assisted by a dental hygienist.

Our method of procedure in the dental clinic of Public School no. 27, in the Bronx, is based on five years of experience in that school. An entire class of children of the 1A grade, averaging about fifty in number, is selected for complete dental operative work. One child at a time is taken out of the class room so as to cause the minimum amount of interference with the routine school work. The entire mouth is then examined in the "dental room" (as we call it in the school), and each defect is noted on an official record card. This plan is continued until every child has been examined and a diagrammatic record of each mouth filed. The next step is to notify the parents, by giving each child an official card, signed by the principal of the school, and requesting a parent to consult the school dentist regarding the dental defects in the child's mouth. When the parent calls, the record of the case is shown and carefully explained. The parent is told that the entire class is about to undergo dental treatment. As no exceptions can be tolerated, the child must be taken to a dentist for treatment. In numerous cases, however, parents report that the dental work to be done is too costly and that, much as they would like to comply with our orders, they cannot afford the expense involved These claims are investigated by our school nurse and, when a satisfactory report is made, the parent is required to sign an "official-consent card," which is then filed in the active operative list.

In many cases parents report that they have taken their children to dentists, with the result that either the children did not permit the dentists to take care of the teeth, or the dentists stated that it is best not to have children's teeth treated at an early age, for "the teeth will drop out anyway." This statement has been made by dentists to parents in hundreds of instances. Such heedless advice is most detrimental to the welfare of children. If parents are permitted to be misled by such statements, many permanent teeth in children will be lost. Many or rather most parents mistake the first permanent molars for deciduous teeth.

Very often parents, in their desire to coöperate with us, tell of their efforts to bribe their children, through promises of visits to the "movies," or of presents such as a pair of skates, or a doll, to permit the family dentists to proceed with necessary work. In nearly all cases, particularly where

the bur must be used effectively for the proper preparation of a cavity in a first molar, attempts at private dentistry terminate in disaster.

After failure of the family dentist, the little patients are entered on our records for treatment. In nearly every such instance the case is successfully terminated in the school clinic, without a parent being present to witness the operative work and without the proffer of a bribe. This highly satisfactory result is obtained because the dental work has become a part of the school discipline. Under this discipline, the child enters the dental operating room without the slightest fear or trepidation. It is well known to educators that school training and discipline are very different from home training and discipline. This explains the fact that, in connection with our work in the schools, children never protest to a teacher when sent to the dental rooms, but seldom fail to debate, with their parents, the desirability of submission to proposed dental operations.

When all cases have been filed for operative procedure, the child that was first examined is again sent to the dental room by the teacher. If there are any cavities in the first molars, these cavities are very carefully prepared and filled with amalgam. In deep seated cavities, silver-nitrate cement is used under the amalgam, which is then polished. Subsequently, all cavities in the deciduous teeth are filled, and putrescent teeth and roots are extracted. Finally, the teeth are given a thorough prophylactic treatment. This means not only the thorough cleaning of the teeth by the school dentist, pending the employment of dental hygienists, but the most painstaking instruction of the child regarding manipulation of the tooth brush (including sanitary care of the brush) and the necessity for brushing the teeth after every meal and before retiring.

This procedure is continued until every case in the class is completed. The same plan is carried out in other grades of the school in a similar way. As a result of research along the lines of school dental clinics, a recent addition to the service at "P. S. 27" has been the daily training of the five-year old kindergarten children in a correct method of brushing the teeth, preceded by prophylactic work.

It does not require much imagination to enable dentists to see the value of this type of service, for the immediate benefits to each child, such as the absence of frequent tooth-aches, increased efficiency in studies, and mental and physical improvement, are obvious. The process is also educational from a dental standpoint, in that each little patient has been trained in his or her school life not to fear the dentist. As a result, in later years, when the early training received in oral hygiene causes them to seek the service of a dentist, how much simpler it will be to operate on such patients,

and how superior the type of service that can be rendered. Furthermore, in these days when dental literature is full of references to oral hygiene movements of all kinds, how can this very important propaganda be better promoted than by giving each child an elementary course in oral hygiene in a school with a dental clinic.

The advisability of giving *free* dental service has been questioned. I should like to emphasize the fact that free *dental* service to school children in a school building does no more to pauperize the parents or the children than does free *mental* training, which all of us approve. *Every child is as much entitled to every possible public health activity in its behalf as it is to a public school education.*

For the past seven or eight years I have steadily opposed the system of centralized dental clinics for the school children of New York. I strongly advocate the unit system—a clinic in each school building. I believe that this is the only solution of this difficult dental problem.

It may not be amiss at this time to recall the remarks of the late Dr. Osler, to his graduating class of doctors of medicine, in 1905: "You have just one gospel to preach, and you have got to preach it early, in season and out of season. It is the gospel of *cleanliness of the mouth and cleanliness of the teeth.* These things must be your text through life."

Preventive dentistry cannot be practised in full efficiency on the adult, but can be best applied in childhood, during school life; though, of course, preventive dentistry is as necessary for the adult as it is for the child. It has been the consensus of opinion, however, that the most trying thing, in teaching adults the practice of preventive dentistry, is the inability of dentists to obtain their patients' coöperation in the faithful massaging of the gums and the brushing of the teeth, which always will be the essentials of mouth prophylaxis. Without this coöperation preventive dentistry is always a failure. The reason for the difficulty in obtaining adult coöperation may be summed up perhaps in the old adage: "You cannot teach an old dog new tricks." This difficulty is entirely obviated when the technique of home mouth prophylaxis is thoroughly inculcated in the youthful mind for it then becomes a fixed and orderly habit of everyday life. In this manner only can preventive dentistry be made an assurance for the adult of the future.

I take the liberty of referring again to Dr. Tracy's paper wherein he quotes an editorial from a recent issue of the *New York Medical Journal*, as follows: "So far as we have been able to judge from medical history, the teeth of mankind were never in such bad condition as they are at the present time. We need more dentists and we need better dentistry. Cer-

tainly the man or group of men who will start something that will make tooth conditions better will confer a great benefit on mankind. . . . ." I believe that the logical answer to this editorial plea is a dental clinic in every public school.

Let us, then, devote more time to the problem of preventing the loss of vital pulps and less time to the problem of how we are going to treat them when their vitality is lost.

In closing, I appeal to every member of the dental profession, in the interest of the children and our own welfare, to aid in bringing about the establishment of a dental clinic in every public school.

THE PUBLIC-HEALTH PROBLEM

E. BRIGGS RIBLET

The public-health problem discussed in this paper is the dental public health problem, with particular reference to conditions in the city of Greater New York.

Every city and town has a dental-health problem. One phase of the problem in this city is the fact that the "foreign" population of Greater New York averages almost one foreigner or person of foreign parentage in every three; in the school population it averages just a little higher—not quite one in two. The intricacies of our problem in New York City are evident from these facts.

For many years, and in particular for the past ten years, the dental profession, as well as the medical profession and the associated lay organizations that are concerned with promotion of the public welfare, have learned to teach and are successfully teaching the value and the importance of proper attention to conditions in the mouth. Understanding of the importance of oral hygiene has become almost universal.

The effect of this widespread teaching of the value and relation of proper attention to conditions in the mouth, has become apparent in the great public demand for dental service in order to correct and improve the situation now known to exist, as well as to prevent the development of conditions that can be prevented by proper attention if given soon enough. Many physicians now inform their patients that almost any ailment can be improved, to some extent at least, by correction of irregularities or improper conditions in the oral cavity. The public not only now believes these facts, but has begun to realize the actual value of them; and the demand for dental attention steadily increases as a consequence. Many industrial dental clinics have been established from a strictly business point of

view. Commercial houses, realizing their employes' need for dental service and the fact that inability to secure such service impairs the efficiency of the employe, have, at their own expense, established dental service, knowing that they would thus save money over and above the actual expense necessary to maintain such service. Similarly, there is not a life insurance company that does not realize the truth and the importance of the fact that attention must be given to the development of dental facilities —and for obvious reasons.

Let us consider the nature of the public dental facilities in this great city at present. There are hospitals that maintain dental service in its many forms; there are public dispensaries that maintain it to a certain extent. The most advanced of these facilities is expressed in the resident dental-interne service in some of the hospitals. In general, however, I am sorry to say, where the service is anywhere near complete, it is usually limited to the inmates of the institution; or, in the case of dispensaries, it must be limited to certain days or hours. It is a curious fact that, in most hospitals, dental work there is always contingent upon the patient's admittance or acceptance for some other physical reason than a dental condition. Yet most medical authorities claim that upwards of 90 per cent of all physical ailments have their entrance or origin in or through, or are associated in some way with the avenue of, the oral cavity. In the dispensaries or clinics, so called, it is difficult to obtain consecutive dental service, the reason for this being that all of these institutions have tried volunteer dental service, which always leads to failure or something very close to it.

Why should dental professional service in a clinic or dispensary be on a salaried basis rather than on a volunteer foundation? Because custom has made it so and custom is hard to overthrow. Custom has it that medical men shall give part of their time in their early years of practice to attending clinics and in later years to directing them. Remuneration for this work in the early years is not often sought or thought necessary. From the earliest days of his practice, however, the dentist's services are so greatly in demand because of the relatively few dentists that he has never had time to attend to "clinical" work. I am sure these conditions are changing but custom still holds sway. If the dispensaries would give heed to this condition and establish dental service on a business basis, that is, pay their dental operators sufficiently, I know that such clinics would not only maintain themselves but be financial assets to the hospitals or institutions that fathered them. Most people who seek dental treatment are willing to pay moderate fees for such service.

The Department of Health long since has appreciated the conditions in the dental field. It has faced the problem chiefly from the child's point of view. With the funds allotted to it by the city, the Department has established eight dental clinics for the exclusive use of school children. It also provides dental service in the Bureau of Preventable Diseases. For eight years the Department of Health was unable to increase its dental program in any way. During the past year and under our present Commissioner, however, it secured an appropriation that was large enough to enable the Department to double the amount of its present dental work. All the way along the line the Commissioner fought successfully to obtain this increase. Only an unfortunate necessity for strict economy within the Department prevented the Commissioner from extending the work. I think the dental profession in general owes a debt of gratitude to Dr. Copeland for this service, an achievement that was really heroic.

The work done by the Department of Health, Bureau of Child Hygiene, is exclusively for children and is purely preventive in aim. However the service is greatly limited, chiefly because of financial conditions. Speaking from a strictly dental point of view, the clinics are able to attend to only sixty thousand in a school population averaging over nine hundred thousand. The latter total includes only the public kindergartens, the public elementary schools, the public high schools, and the parochial schools of the same classification, and does not comprise the attendance at any of the private schools, estimated at over two hundred thousand. The estimated number of children of pre-school age is five hundred thousand. The relatively insignificant effect of the service is evident from these statistics. The Department of Health gives its dental service, in a "*total*" way, to only ten schools, and to perhaps a hundred schools in an *emergency* capacity, this number being only a little over an eighth of the total number of public schools in Greater New York. Through the agency of its medical inspectors and school nurses, notwithstanding their numerous other duties, the Department of Health instructs children in their dental needs, but this contact with children as it relates to the dental problem seldom bears a fruitage of fifty percent in positive results.

Recently the Association for Improving the Condition of the Poor, cooperating with the Department of Health, has entered the field in the City of Greater New York, as has also the New York County Chapter of the American Red Cross, in order to demonstrate not only the value of this work, but also its practicability and its limitations, from both the dental and financial points of view. Many other organizations, in their own limited financial ways, are endeavoring to "do their bit" in this field. Their success has not been great.

It must be remembered that, on the whole, the facilities that have been developed to date are the result of the new intelligence and understanding of the importance of dental attention, and of its close relation to the promotion of health in general. It has taken a number of years properly to develop both this conception and this realization. In the meantime the population of the city has multiplied many fold, far beyond the scope of the service that can be given at present. This service has fallen so far behind that the lack of public dental facilities in this city is notorious.

Heretofore the chief endeavor to solve the public dental-health problem has been the treatment of children. I realize that the child is the most important unit in the dental program in general; but the administrators of public health must exert themselves in behalf of the entire population they serve. Therefore, while the health of the children is undoubtedly our major concern, the adult population must not be neglected. Matters affecting the public health are the concern of everyone. Anyone who can contribute to the betterment of health conditions is morally obliged to do so. From a civic administrative point of view, of course, the execution of measures for the promotion of the public health is primarily the function of the Department of Health.

In the development of public administrative affairs, the educational function was first enlarged. Following creation of the educational function, there was added, in the laws of this state, the health function, to be administered by the educational authorities in small towns where no health body existed. Later, in the development of the laws of this state, when the importance of health in its relation to education was understood, health departments were created in the larger cities and in the cities that could maintain them. Where there is no health authority, the educational authority must necessarily function in its place. In the larger cities and in cities where the importance of the health program is understood, and a department of health exists, the supervision of the health of the public includes the protection of its health from a dental point of view as well as any other.

It is the duty of a Department of Health to do everything within its power to prevent suffering from dental defects through ignorance or from lack of facilities to correct them. It is one of the duties of a department of health to see that various organizations in its territory are properly stimulated to furnish necessary dental facilities, if a deficiency in this respect is gross enough to bear a definite relation to the health of the community.

The ideal way for the city to administer that part of the dental-health program that affects children would be to place a dental clinic in every

school. To do this would necessitate an initial expenditure of nearly two million dollars, an amount that is almost prohibitive. At present the city cannot be induced to expend such a sum for that purpose. It would not be fair to expend for the benefit of a few the limited amount of money that the City is willing to appropriate for the support of the work of the Department of Health. If we expend our resources in an earnest endeavor to cover the whole field, despite the inadequacy of the available funds, we can then sincerely ask for a greater fund, and may hope to get political support sufficient to secure it, because of the need for the service and the reasonableness of the request. We must be sure that our program for administering moneys given to us is sound and proper from the financial point of view as well as from the dental standpoint.

It has been demonstrated by many different bodies that the public and the children now associate with the dentist the mention of dental matters or anything to do with the mouth. The medical profession has developed the just and proper habit of referring anything relating to the mouth to the dentist. Therefore, it is obvious that public dental-health work must be done by dentists or under their supervision. The popular association of the dentist with this endeavor is so strong that those who receive formal requests or instructions, signed by *dentists* and relating to dental conditions in the mouths of children, respond to a degree that is from 30 to 50 percent greater than in the cases of similar requests from nurses or physicians.

In the Department of Health the nurses and medical inspectors touch upon this work solely as it relates to children. They endeavor to teach the child to attend to the correction of its dental defects. Positive results are obtained that average, as was mentioned before, in the neighborhood of 50 percent. Using the same means, but administered by dentists or dental hygienists, the Department at one time proved that it could add another 30 to 50 percent to this ratio—nearly 100 percent—though limited of course, to the area worked upon.

For several years, almost everyone, in realizing the lack of facilities in the dental field of endeavor, has regarded conditions as hopeless. Instead of trying to place the burden where it belongs, namely on the private, semi-private or semi-public hospitals, dispensaries, clinics or such, all have tried to force it wholly on the City. Just how far the City has been able or ever will be able to shoulder the load is shown by the fact that the City is exactly where it was when the task was attempted eight years ago. So long as any city department undertakes to do the necessary work in this connection, just so long will the development of other facilities be held back.

Dental facilities can and must be created. It is not a hopeless matter. Everyone is going to help. The medical profession realize at last that the dentist is a full brother and that dental work is a factor not only in oral hygiene but in public health work as well.

If the time ever comes when the Department of Health of this City receives funds sufficient for the establishment of a dental clinic in every school, I hope the work of the Department will be extended by the addition of such clinics. I fear that day will never come, however, because many other correspondingly heavy and prohibitive demands on the City's resources would be involved.

I have touched only upon general recommendations. Whatever the details in the solution of this problem may be, the following main points stand out clearly:

A. The entire matter is a public dental-health problem.

B. The problem includes the entire population and not the children only.

C. There is a woeful lack of public facilities for dental service.

D. The work should be done by dentists and dental assistants.

E. It is the duty of the Health Department to see that this problem is solved in its entirety as a health issue.

I present this paper for the consideration of the Commissioner of Health as a statement of conditions and as an aid to solution of the problem. I have not intended in any way to be critical but rather, by recitation of facts, to make it evident that the Department of Health should be complimented and appreciated for having accomplished what it has in the dental field, with a small staff and limited means. The time has come, however, to place the dental-health problem in its true position in public affairs, in order that prevailing conditions may be improved as greatly and as rapidly as possible.

DISCUSSION OF THE PAPERS BY M. M. BLUHM, ON "PREVENTIVE DENTISTRY IN THE PUBLIC SCHOOL SYSTEM" (PAGE CV), AND BY E. BRIGGS RIBLET, ON "THE PUBLIC-HEALTH PROBLEM" (PAGE CX)

By Commissioners Royal S. Copeland and Bird S. Coler, Mr. Arthur T. Gorton, Drs. Maurice S. Calman, Wm. D. Tracy, and Louise C. Ball, of New York City; and Drs. Bluhm and Riblet

Dr. Bluhm (before showing moving pictures appropriate to the theme of his paper): This film is essentially a propaganda film, and not an oral hygiene film. With its help we hope to persuade a certain organization—I regret I cannot mention its name—to finance, at a cost of about $10,000,000, the establishment and maintenance of a dental clinic in every public school in this city. (Dr. Bluhm then presented and discussed the moving pictures referred to.)

Dr. Royal S. Copeland (*Commissioner of Health, New York City*): I was greatly interested in the papers presented by Drs. Bluhm and Riblet, and in the pictures shown by Dr. Bluhm. The City of New York is about to engage in a fifty million dollar campaign for new schools. It will be a crime if there is not a well equipped dental room in each of these new schools.

It is a pathetic fact that a physician in ordinary practice is so shut in with, and so surrounded by his own thoughts and experiences, that he rarely sees things from the standpoint of other professional men. Both of the gentlemen this evening said the administration of dental affairs in the Health Department—I think that is about the way they put it—should be in the hands of dentists. I agree with that fully. During the war, we learned many things about the physical condition of the men of draft age. Ten million men were examined. A very large number, an amazingly large number, were rejected. Between eight and nine out of every ten were rejected on account of dental defects. In a class that graduated from one of our grammar schools, a year ago last June, there were seventy girls, of whom one girl had perfect teeth and the remaining sixty-nine had an average of seven dental defects.

Dr. White, of Minnesota, made a survey of all the admissions to the hospitals there, for whatever cause. He found that 12 per cent were due to troubles that could be traced to dental defects. In our schools we find a large number of children with cardiac troubles. If a careful examination were made, how many would be found to be due to defective teeth? I am satisfied there ought to be a dental room in every school house in the city.

With a dental room in every school house, the children would get used to the odors, and to the conspicuous features of a dental office—the buzz of the engine and all the other things that are so trying to the layman. I believe that that familiarity would tend to make the child a better dental patient; and that, instead of dodging dental service from fear, as so many of us do, the child would submit readily to any necessary dental operation.

I congratulate the dental profession. In this generation when everybody is seeking money, and grasping every chance to get it, it is very altruistic for your profession to be so insistent in regard to the establishment by the city of dental clinics in the schools. Your attitude speaks well for your generosity and your professional spirit.

An important phase of this question is the problem of public education. If Dr. Bluhm's pictures could be seen by everyone in this community, your purpose would be promptly achieved. No one can doubt the importance of prophylaxis. How much more important it is to prevent disease than to cure it. If, by early attention, development of the dental defects that are so common can be prevented, think how much you could do. Today I had a meeting in my office of the representatives of the Transatlantic Steamship Company, the officers from Quarantine, and the Commissioners of Immigration, to consider a phase of the problem of prevention. There have escaped into the community a number of persons who had been exposed to typhus fever, and several cases have developed here. How much better it is for the United States to spend money to "delouse" these immigrants, and to sterilize their baggage and clothing before admitting them—to spend a few thousand dollars in a prophylactic way—than to appropriate the millions necessary to control an epidemic of typhus fever that follows the admission of those who introduce the disease among us.

You are proposing prophylactic measures. You desire to treat the children before dental trouble begins. You are engaged in the finest piece of public-health work I know of. I am thoroughly committed to the use of every possible influence to bring about the establishment of a dental clinic in every school house in this city. I am glad to co-

operate with you in this important enterprise. I hope, as time goes on, we shall bring this problem to a successful solution and have, as we ought to have, *a dental clinic in every school.*

Mr. Bird S. Coler (*Commissioner of Public Welfare, New York City*): I did not come here tonight to make an address but just to listen, especially to Dr. Copeland.

In our department we have about sixteen thousand children. Three or four years ago we had approximately twenty-one thousand, but the number has diminished. As far as our children are concerned, from the dental point of view, they come to us at our clearing bureau and, immediately after they are washed, their teeth are examined and charted, and everything the matter with them is followed up. We have very complete dental facilities for this purpose.

I am as much interested in the matter under discussion as Dr. Copeland or anyone else. I do not want to throw the least bit of cold water on this project, but I must advise you to be conservative in your desires. I believe thoroughly in taking care of the teeth of the children, but I do not ignore the very active agitation for similar facilities in other relations. I shall be very glad to help to extend the dental educational service in every safe way. There are so many things to be done; but if you ask for all at once, nothing will result. You must start by showing the necessity for a thing. Then you must work it through gradually.

I cannot imagine a man more miserable than one with something seriously the matter with his mouth, if he is sick enough to be in bed. It is a surprising fact that we have had a dentist in Bellevue hospital for only a few years. I do not know why we did not have oral surgeons in the hospital sooner. We began real dental service at Randall's Island two or three years ago. We have two or three dentists there now. For nearly a century feeble-minded children there were without such care. It is wonderful what the proper care of the teeth will do for feeble-minded cases.

Perhaps we cannot have a free dental clinic in every school until we can also have the tonsils removed free, in every school, and so on. We must work earnestly and conscientiously for the poor—let those who can pay for service take care of themselves.

Arthur T. Gorton (*Principal of Public School no. 27, New York City*): From what I have heard here, I imagine that in the near future you will receive testimonials like this: "To the First District Dental Society:

Gentlemen:

Since having my bad teeth removed, and the small cavities filled, all my previous ailments, including housemaid's knee and an ingrowing toe nail, have entirely disappeared.

Yours truly,
John Smith."

Such a testimonial would accord with the idea some people entertain regarding the power of preventive dentistry. I would not go as far as that myself, but I know, from an experience of six years with work on the teeth of children, what preventive dentistry will do.

You may be surprised by the statement that 96 per cent of the number of children in New York City have individually from two to ten badly broken-down teeth. In forty-five children eleven years old, in one class examined a short time ago, we found

an average of five teeth that required immediate extraction. Similar conditions prevail among the children in all parts of the United States.

It is estimated that a dental clinic in every school would cost ten million dollars. Do you know how much is paid in salaries to the public school teachers in this city? The total is more than seventy million dollars. Do you know that a state law requires that two hundred to three hundred minutes a week shall be devoted to physical exercise—one-seventh to one-fifth of the entire school time, or approximately one day out of five? That means that one-seventh to one-fifth of the total paid for salaries, approximately ten million to fourteen million dollars, is expended yearly for physical training—for teachers' salaries to be spent on physical drills, the teaching of hygiene, and two-minute drills in marching to and from the rooms. If we can afford to spend ten million dollars for this desirable service, should we be unwilling to pay as much more to put and keep the mouths of children in good condition—to teach them how to care for their teeth?

I had a child in my school whose mouth needed attention. The mother took him to a dentist. The child made so much noise in the dentist's office that the dentist had to send the child home. The mother saw me about the matter and, after some discussion, signed the school card that is required in every case, and which grants permission to the school dentist to take the case. I then said to the child: "Come with me." I took him into his class-room and whispered to the teacher: "As soon as I go out, take this child to the dental room." The teacher then took him with the card to the dentist. Six or seven of his teeth were attended to and he never whimpered\

Our children are accustomed to the dental clinics and do not seem to be afraid of them. They go to the clinics without protest, perhaps because of two things: they are a little more afraid of me or the teacher than they are of the dentist, because they know us and do not know the dentist—they understand they must obey every order a teacher gives them. The second reason is that they do not wish to show a cowardly spirit before the other children.

An entire class was taken care of four or five years ago. The members of that class are still in the school. They are at least 25 per cent better, mentally and physically, than another class that started with them and which is still in the school but has not received dental attention.

I wish you could come to my school to see the children pictured here by Dr. Bluhm, and all the other children treated in our dental clinic. It is an absolute certainty that a dental clinic in every school in New York City would pay enormously on the investment, and I hope you will all do everything you can to further this end.

Dr. M. S. Calman (*Alderman, 20th District, New York City*): As one who has been vitally interested in the subject of school dental clinics, I gladly accepted the invitation to be present at this meeting.

Dr. Riblet said that it would cost an amount that is almost "prohibitive" to establish dental clinics in all our public schools. As an ex-city-official I can authoritatively inform you that the city administration squanders annually thousands and thousands of dollars on useless and foolish projects, while it always pleads poverty when the question of the health of the people and in particular the health of our children is concerned. Thousands of dollars, for instance, are appropriated and spent every year in the purchase of very costly automobiles for influential city politicians who are too lazy to walk, or consider it beneath their dignity to ride in the 'L' or subways in attending to their duties. This is merely one of many instances of the waste of city funds.

Doctor Riblet thinks that care for the health of the children is a semi-private or private matter only, and not a matter of governmental concern. To me the word "government" signifies "the people." I believe it is the duty of those we put in power to care for the health of the people. It is not the duty of the Rockefellers, Morgans, Goulds or other private citizens. It is a public duty, not a private responsibility.

Dr. Riblet also said he fears that the day will never come when the government will go into this matter of looking after the dental health of the school children. His remark reminds me of a story about Fulton's steamboat. As she was about to steam up the Hudson on her maiden trip, people gathered all along the shore. In the crowd, at One Hundred and Tenth Street, an old lady was quite positive that the boat could not possibly go up the river. She kept saying to her neighbors: "It will never come, it will never come, it will never come." But, sure enough, the boat came chugging along in good time and the lady, not wanting to admit defeat and to console herself in her dilemma, exclaimed: "It will never stop, it will never stop, it will never stop." Yes, Dr. Riblet, the question of the public health will not be settled right until the government assumes full responsibility for the health of the people. For some years England, by legislation, has recognized this function as a proper governmental duty, and now is about to include dental care in its legislative program. The agitation was commenced years ago and there were those who said that "it will never come;" but, now that it is coming, we shall not be surprised to hear these skeptics and doubters say that "it will never stop."

Commissioner Copeland is a very fine man. He put up a good fight for the establishment of additional dental clinics in our public schools, as provided for in a bill I introduced at a meeting of the Board of Aldermen, and which was formally approved by that Board not less than five times and signed by the Mayor. But the Board of Estimate, including the Mayor, failed to provide the funds my bill called for and the clinics have therefore not been established.

Commissioner Coler says that we should go about our demands for school dental clinics in a conservative manner. For three years the promise has been made to us that the necessary funds would be appropriated, but today we are no farther forward than we were at the start. I do not know how much more conservatively the Commissioner expects us to proceed in this important matter.

Mr. Gorton said, in effect, money is no object; why should it not be spent on health matters? I thoroughly agree with him. It costs the State millions of dollars to re-educate children who have been "retarded," in most instances by dental defects. Then again the health of the children being impaired by lack of proper dental care, thousands of them fill charitable, correctional and penal institutions, while others are rendered sub-normally productive when they grow up. From a business point of view alone, disregarding the humanitarian and sentimental aspects of the question, the State would save millions of dollars on an investment of some thousands in medical and dental clinics. It would save that sum on money spent now to re-educate the children; on the cost of maintenance of the numerous charitable, correctional and penal institutions; and in the greater productivity of a healthy citizenship.

There is, at present, a resolution before the Board of Aldermen calling on the Commissioner of Health to institute nine additional dental clinics in as many public schools of our city, as was provided in the Budget appropriation of the Department of Health for the year 1921. Accordingly, I think the next step we, the First and Second District Dental Societies and the Allied Dental Council, should take is to petition the Board to pass said resolution and to urge the Mayor to sign it. The Commissioner is willing to

go ahead with the work. If we "put up" a fight for this and win, the desired small appropriation of $40,000.00 will be made and there will be at least nine additional dental clinics in our schools.

Dr. Wm. D. Tracy (New York City): I think we are agreed that we have had a feast of food for thought. We have had two essays, a moving picture, addresses from our Commissioners of Health and Charities, and talks from one of our school principals and one of our aldermen, showing that the subject of the evening is in the minds of professional men and laymen throughout the country.

It is unfortunate that ideals are unattainable; but if it were not for ideals, the march of civilization would be much slower than it has been. I understand the position taken by Dr. Riblet in his paper. He is not lacking in ideals but, in the presence of the seeming impossibility to get funds to do the ideal thing, he offers a suggestion that he hopes will make it possible to do more under existing circumstances. He is not giving up the fight. For nine years—more definitely, perhaps, in the last four or five years—we have tried to bring about conditions that would afford better public dental facilities. I presume Dr. Riblet has made his recommendations in the hope that the time and effort involved would give greater benefit to each of the boroughs in our City. We are spending a certain sum, and are giving only a limited amount of service. The people in Richmond borough think their children are entitled to just as much attention as the children in the Bronx; they are paying some of the expense but they do not derive any of the benefits.

I agree with what Dr. Calman said: the municipality should administer the Health Department in such a way that all departments would be taken care of. I fear it will be some time before this condition can be attained. I believe "a free dental clinic in every school" is coming. I do not say, like the old lady, "it will never come, it will never come, it will never come!" We took Dr. Bluhm's sentiment, "a free dental clinic in every school," as our slogan. Its use should not be discontinued for it is a good slogan.

Dr. Louise C. Ball (New York City): For a number of years I have been greatly interested in the establishment of dental service for children in this city. It is regrettable that New York has been unable to establish more than a few dental clinics, or to give a degree of dental service to more than a small number of children.

Since 1916, when I had an opportunity to organize a course in oral hygiene at Columbia University that has been continued and developed in that university, I have been interested in preventive dentistry, especially in its application to child welfare. In 1917, my experience in conducting the Yorkville District Dental Clinic demonstrated that children's teeth could be taken care of scientifically with relatively little expense and with comparatively little trouble. At that clinic over twenty-five hundred children had their teeth cleaned, cavities filled, and other essential dentistry done, at a total cost of $1,000 for a year's work. This included the salary of a dental hygienist and of a dentist for sufficient time each day to conduct the work efficiently.

From this working example, and after consultation with downtown school officials and principals (this being a very "poor district"), I have concluded that funds in ample amount could be obtained by following the method used in the school library campaigns, with suitable changes and amplifications. I call my plan "dental health insurance for children."

Any child, anywhere, under any circumstances, can contribute one cent a week for service in preventive dentistry. A stamp book may be provided for each child, in which

each stamp purchased with a cent may be placed. During the recent war children showed how much they liked to save by their eagerness to fill their books with thrift stamps. There are in New York City about one million children of school age—at the rate of one cent a week, that would mean an income of $10,000 a week. School authorities, teachers, and principals manifest decided interest in the subject of preventive dentistry. I believe there would be little if any opposition to such a plan. Such a fund as this would place in every school in the city a dentist and a dental hygienist, each on a salary.

Cost of equipment is small. It is not necessary to have an elaborate dental outfit or special quarters in which to do dental work for children. An expensive chair is not a requisite, an inexpensive adjustable head rest, which could be clamped to the back of a teacher's high chair, or to any ordinary chair with a wooden back, would do as well. Sputum cups would eliminate the need for dental cuspidors. The cost of material used in cleaning and filling children's teeth is small, no gold being needed.

I feel that this plan is sufficiently comprehensive, and of sufficient import to all the people, to make it advisable to place it under the direction of a governing body whose principal aim is the conservation of public health. Because I believe that every effort should be made to uphold existing municipal, state and national institutions, instead of creating new committees with no standing, I feel that the federal, state and city health authorities would be the logical directors of such plans. They would have the recognition, support and coöperation of all public-spirited organizations.

The payment by a child of one cent per week would make him a shareholder—it would entitle him to definite benefits, tend to make him a better, a more thoughtful, and a more useful citizen, and eliminate every suggestion of charity.

An interesting illustration, showing personal interest and responsibility, is the result of experimental work by Miss Margaret Moriarty, of Public School no. 158, conducted in the open air on the roofs of the Vanderbilt Model Tenements, where there are about one hundred and fifty children. Miss Moriarty has done much experimental work with her children along lines of preventive medicine and hygiene. In 1918 she was a member of a class taught by me in general and dental radiography at the War Service Training School in New York City. She showed ability and keen interest in the dental division, and later used this experience actively for the benefit of her school children. Miss Moriarty has unusual facilities in this open air school, for the children remain under her supervision through successive grades.

Her first experiment was a simple questioning of the children regarding their mouth habits. The result showed lack of understanding, and in most cases, total lack of home care of the children's teeth. Recognizing the value of a merit system, Miss Moriarty devised an individual graph chart for recording weekly each child's general health, height and weight, and indication of dental work needed and done. Recognizing also the competitive spirit among children, she found it advisable to use two charts: a personal record chart for each child and a special pictorial dental chart for exhibition purposes. In order to be eligible for a place on the latter chart, and the honor of personally signing his own name on it, the child had to show the school nurse, school doctor, and his teacher, Miss Moriarty, clean teeth without cavities.

Those most hated "don't's" of childhood have no place in Miss Moriarty's scheme; instead, stress is laid upon the beauty of good teeth, the joy of fine physical condition, etc. It is most interesting to find that through their interest in these records, the children accept a sane, hygienic and healthful diet, not only unquestioningly but happily. On

their personal charts, they record advances in weight, growth, etc., from week to week, and are keen to watch the graph curve rise to the normal weight mark, which is each child's goal in the health race.

Particularly interesting to me, for I helped Miss Moriarty to work out the details of her plan, was the unusual increase in weight and added brightness in class work in the children whose teeth were properly treated. I made a report of the school experiment, and showed Miss Moriarty's charts, at the Sage Foundation to a group of representatives from seventy-five organizations in and about New York that were interested in child nutrition and which I hoped would actively support such a plan as the one I have outlined to you.

One boy in Miss Moriarty's class in particular had refused persistently for two years to have an abscessed molar removed. His weight was below normal, he was backward in his studies, the school doctor and nurse reported him for petty illnesses. His teacher tried all kinds of inducements, but not until she produced the pictorial dental chart, announcing that it was to be exhibited to the visiting parents on the official health day at the school, did Louis manifest any active interest in his bad tooth. Having seen fourteen other children proudly sign their names in bright red crayon on the "Dental Honor Chart," Louis demanded his privilege. Again the teacher patiently explained that until his bad tooth was removed his name could not appear on the chart. Louis promised to have the offending tooth removed next week, but Miss Moriarty gently stressed the point that *today, and today only*, was the time, tomorrow being the day of exhibition. Finally Louis, seeing that there was no alternative, said: "All right, gimme my cap, I'll do it now," and ran from the room. Being a true psychologist and understanding her children very well, no comment was made by Miss Moriarty on the abruptness of Louis's departure, or his absence during the rest of the afternoon. The following morning the triumphant Louis appeared, tooth in hand, announcing proudly: "Now I guess I can sign, and my name's the end one, too."

I suggest the "dental-health insurance plan" in the belief that, as a dental organization, we could suitably sponsor it. I should be very glad to assist in working out the details on any plan of presentation that might seem to be advisable.

May I add that there is a large "eligible list" of available dentists, whom I personally examined under the Municipal Civil Service Commission of New York in 1918, but only one of whom was appointed because of lack of funds. There is also an available list of dental hygienists.

Dr. Bluhm: I might add, as a matter of record, that when the establishment of a dental clinic in every school is finally accomplished, the Department of Charities will find such clinics entirely beyond its jurisdiction, as it should be.

Dr. Calman believes that it is wise for the municipality to establish and maintain a dental clinic in every school. In a sense I agree with him, *but* the difficulty on that score will be that if, during a given city administration, funds are voted by the Board of Estimate for the establishment of clinics in some of the schools, the succeeding administration, in an effort to make drastic cuts in the budget on a political plea for "economy," may decide to close the clinics. On the other hand if a philanthropist, or an organization, should present these great health agencies to the city, the clinics would not be discontinued.

The total cost would not be $10,000,000 *per year* as Mr. Gorton suggested, but that sum alone, plus the interest or income that would accrue therefrom, would be sufficient to establish and maintain a dental clinic in every public school in Greater New York.

Dr. Riblet (*in conclusion*): Commissioners come and commissioners go, and there are big and small departments, but some of you may remember that Commissioner Coler has stood before administration after administration, and in his quiet way has accomplished a great deal.

We all aim to accomplish the same purpose. My object is the same as Dr. Bluhm's. He agrees with me in the conviction that a sufficient appropriation can never be obtained from the city administrations, and also that a very large sum is required to assure success. As Commissioners Copeland and Coler said, it is the duty of both their departments to take care of *all* the people, and not merely of one or two groups of the people. If every one of you would earnestly preach the idea that we must "get the money" in a *large sum*, and not in driblets, it would help. In the meantime we must do the best we can. I assure you of my sincere service to this end.

Referring to Dr. Ball's suggestion, that each school child be asked to contribute one cent per week in order to raise sufficient funds for these clinics, I might say that a similar plan was proposed by the Oral Hygiene Committee a year ago, to the Department of Education, but permission to collect funds for the purpose was refused by the educational authorities. In my opinion a plan of this kind would not be feasible.

THE ORAL SURGEON: HIS POST-GRADUATE TRAINING, HIS OPPORTUNITIES AND HIS RESPONSIBILITIES[1]

WILLIAM C. FISHER

New York City

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I. INTRODUCTION

I realize that my subject is an extremely difficult one to discuss, because at present there seems to be a tendency for different specialties to spring up in the dental profession. While this may be more or less desirable, it nevertheless remains true that only a few specialties of dentistry have been developed to a point where they can be practised as specialties, separate and distinct.

Dr. A. W. Thornton, Dean of the Dental Faculty of McGill University, speaking on the subject of specialties in the dental profession says: "There is not room for more than two specialties, one the specialty of orthodontia, and the other the specialty of oral surgery. Why do I except orthodontia and oral surgery? As to orthodontia, the reason is that the practice of this specialty requires a special fondness for and ability to get along with children. It calls for a high standard of mechanical ability, and a very accurate knowledge of the anatomy of the parts affected." I do not think that the work carried on in our schools has been sufficiently broad to enable a man to go out and practice orthodontia.

Now for the case of the oral surgeon. Just there we approach the border line between dentistry and medicine. Thornton contends that "knowledge of both medicine and dentistry is essential to the successful practice of the specialty of oral surgery, but with their chief interest centered in

[1] Read before the Section on Oral Surgery of the First District Dental Society of the State of New York, November 16, 1921.

dentistry, because in the final analysis the permanent condition must rest with the skilled dentist."

It is true that members of the dental profession, such as periodontists, may question the wisdom of Dr. Thornton's limitations. However, to orthodontia and oral surgery I might add prosthesis or the construction of full dentures, because this specialty can be practically distinct from any other operation of dentistry. Orthodontia and oral surgery while separate and distinct are more or less correlated.

The recent world war proved to the satisfaction of practically every one that the department of maxillo-facial work could not have functioned satisfactorily except through the skill and coöperation of oral surgeons and orthodontists; and unquestionably the finest work was done either by direct teamwork of these two specialties or by individuals well grounded in the principles of both of the specialties. It is on this account that, in speaking of specialties of dentistry, we have to consider orthodontia and oral surgery as the means of comparison. This Section of Oral Surgery is, of course, interested in oral surgery but societies such as this will do well to consider the manner in which orthodontia has developed and some of the reasons for its development.

II. THE TRAINING OF ORAL SURGEONS AND ORTHODONTISTS COMPARED

Considering the fact that men are going to specialize in orthodontia and oral surgery, the question of education for these specialties becomes one of more or less importance. Men who possess great knowledge and unusual technical skill, of course, are best qualified to specialize. We may stop, then, for a few moments to discuss the qualifications of a specialist. We are aware of the unfortunate fact that many men in both orthodontia and oral surgery have become specialists overnight. They have decided to specialize because they have been attracted to the particular field of endeavor by the financial reward they hope to attain. The financial attraction has been a deciding factor with them and not their ability. It is an unfortunate thing that the public has no way of preventing a man from specializing who does not possess the ability to justify his doing so, and the public can only have redress in the legal ruling which holds that *the specialist must show extraordinary skill.* This question of *extraordinary skill,* or lack of it, is brought to light when some individual is made to suffer by a man's lack of experience.

There are but three avenues whereby a man can qualify as a specialist and still be fair to the public: (1) He may devote special attention to certain subjects for a number of years and, by the accumulation of skill and

knowledge extending over a long period of time, may finally be sufficiently qualified to specialize in some particular line. (2) He may associate himself with some man who has already acquired skill along a particular line and serve as an assistant to that man for a number of years. (3) He may take a recognised course of training in some school qualified to give extraordinary instruction in the specialty which he is going to practise.

The foregoing statement brings us face to face with the proposition that, for a number of years, orthodontia has fortunately possessed post-graduate institutions that have been far superior to any post-graduate institutions giving instruction in oral surgery. The majority of men who have specialized in oral surgery have, therefore, been forced to reach their profession by one of the other two remaining routes, namely, by years of practice or by serving an apprenticeship to oral surgeons. In the past there have been so few oral surgeons that the question of apprenticeship was one of extreme rarity. Years of practice remains the only other means of acquiring knowledge sufficiently to justify specialization; and the trouble with that is that many men have cut "their years of practice" to specialize without a proper foundation.

It will probably be some time before post-graduate instruction in oral surgery will have reached the high standard of that in orthodontia, because post-graduate instruction in orthodontia in a recognised and creditable manner has existed for twenty years. Oral surgery today is practically twenty years behind orthodontia, because no post-graduate courses in oral surgery can in any way be compared with the post-graduate instruction given in orthodontia by the Angle School in 1900. Since that time post-graduate instruction in orthodontia has advanced, until very few dentists attempt to specialize in orthodontia before taking a post-graduate course, or serving a certain number of years of apprenticeship with a man of recognized ability.

III. THE NEED FOR SOCIETIES DEVOTED TO THE ADVANCEMENT OF ORAL SURGERY

Another thing which has advanced education in orthodontia beyond that of oral surgery has been the organization of societies for the promotion of orthodontia as a science. The American Society of Orthodontists was organized in 1900. Their first meeting was held in 1901 and meetings have been held every year since. They have grown to be a national body which is not only a power in the regulation of things orthodontic, but even a power in the regulation of things in the dental and medical worlds. Oral surgery at present (November, 1921) has no national society. The only

thing approaching it is the American Society of Exodontists which, as you know, was organized primarily to help those who limit their practice to the extraction of teeth.[2] Some admit that exodontia is a part of oral surgery, but a great many oral surgeons refuse to accept that fact.

It is my belief that oral surgery will never occupy a high place until a number of men who are practising this specialty realize that they must unite for the common good of the specialty, and ignore their personal likes and dislikes and petty jealousies. Another thing which prevents oral surgery from having a national society is the fact that surgical technic has not been standardized. Even such a common operation as that for the correction of cleft palate is by no means standardized; and a great many men are individually performing operations by certain methods because Brophy, Lane, Federspiel, or someone else recommended the particular technic employed, in a given instance, without making a careful analysis of the situation. Therefore, one thing that oral surgery must do that orthodontia has done is to produce a more or less standardized method of technic and treatment.

It is true that orthodontia for a number of years had to contend with petty jealousies among some of the older men, and possibly oral surgery will never be united as it should be before we have a few respectable funerals. This is said with all due respect for the older men; but some of these men, who have developed a particular technic, seem to have made up their minds that unless their technic is accepted by the prospective society, there shall be no society.

One of the difficulties in the way of formation of a national association of oral surgeons has been the fact that some of the older men, who have attained considerable reputation because they have performed several cleft-palate operations, contend that a man is not an oral surgeon unless he performs the cleft-palate operations. Fortunately for the human family, there are not enough cleft-palate cases to allow all of the oral surgeons to perform many operations of that kind. However, it must be remembered that the correction of cleft palate and harelip is not all that is included in oral surgery. We must divide the subject and recognise the fact that there is major and also minor oral surgery. The extraction of teeth, and even curettement of an abscessed cavity or the removal of the end of a root, may be regarded as minor oral surgery. But in the case of the impacted third molar we reach the dividing line: some claim that its removal is minor oral surgery, while others, because of superior technic, claim it is

[2] The American Society of Exodontists was converted, last August, into the American Society of Oral Surgeons and Exodontists.—(W. J. G.)

major oral surgery. So it is going to be difficult to decide exactly what oral surgery comprehends; and it is my belief that any national society that is going to amount to anything will have to recognise the fact that there is both major and minor oral surgery to be done, and will not deny membership in such a society to men who do only minor oral surgery.

IV. OBJECTIONS TO THE PAYMENT AND ACCEPTANCE OF COMMISSIONS (DIVIDED FEES)

We might also consider the attitude of the specialist to the profession in general. Ordinarily the dental profession should be the best judge of a man's ability to practice oral surgery, because they know more about it than the general public. An oral surgeon as well as an orthodontist should stand upon his ability, but unfortunately in the past that has not always been the case.

A few years ago the American Society of Orthodontists placed in their constitution and by-laws a clause prohibiting orthodontists from dividing fees with the general practitioner. To use a common phrase: a number of orthodontists were guilty of paying commissions. Commissions should not influence a man in referring patients, but a great many of us are not beyond the influence of the dollar; and if we were called upon to choose between two individuals *the ability of both being very nearly the same*, one giving commissions and the other not, we would practically all refer our patients to the man paying commissions. If it stopped with such a situation, it would not be so bad; but as it was in orthodontia and in general medicine so it will be in oral surgery: if oral surgeons pay commissions to the dental profession, the best commissions will influence dentists in referring patients. Therefore, for the salvation of the specialty of oral surgery, as in the case of orthodontia, effective action should be taken against payment of commissions and such action should come from this Section of Oral Surgery, because, strange as it may seem, the Section on Oral Surgery of the First District Dental Society of the State of New York is, I believe, the only organized society of Oral Surgery.

V. THE NECESSITY FOR THE DEVELOPMENT OF LITERATURE ON ORAL SURGERY

Another important factor in the development of orthodontia has been the establishment of a literature of its own. With the formation of the American Society of Orthodontists and the publication of the proceedings of the American Society in separate annual volumes, orthodontia very early had a literature that no other specialty in dentistry possessed. Later,

the formation of the *International Journal of Orthodontia and Oral Surgery*, which was the first journal devoted exclusively to the specialties of dentistry, was also a forward step in the advancement of orthodontia as a specialty.

As a rule articles on oral surgery are crowded to the back pages of medical journals and are not given the proper attention they should receive, if the specialty is to advance. We often see that papers on oral surgery, read before the Section on Stomatology of the American Medical Association, are refused space in the *Journal of the American Medical Association*. It seems to me, then, that oral surgery should try under every condition to work up a literature, and should at least support a journal that gives oral surgery the recognition to which it is entitled.

VI. CONCLUDING REMARKS

In summing up our ideas on the specialties in dentistry today, especially oral surgery and orthodontia, it is our belief that oral surgery will take a great step forward when oral surgeons organize societies devoted to their specialty. There has recently been organized the New York Society of Orthodontists. Why should there not be the "New York Society of Oral Surgeons?" Orthodontists early realized that, if they wanted to develop their societies, they must be unhampered by other organizations. That affiliation with other societies is quite a handicap is proved by the fact that the Section on Orthodontia and Periodontia of the NationalDental Association is a very weak organization compared with the American Academy of Periodontology and the American Society of Orthodontists.

The courses in oral surgery, so called post-graduate courses, are legion. A man can get them in almost any city at almost any price that he desires to pay. Some special plan must be devised for the development of satisfactory post-graduate instruction in oral surgery, as has been the case for orthodontia—men are willing to take special courses in oral surgery that really teach them something. The result will be that there will be fewer men specializing in oral surgery without proper preliminary training.

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SOLUBLE SALTS IN SALIVA AND URINE[1]

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This note relates to a study of the salts that may be detected by the method of evaporating a drop of clear urine or of salivary dialysate and photographing the residue through an ordinary microscope with a no. 3 Leitz objective, arranged to give a magnification of about 60 diameters.

Crystals were obtained from saliva by the method suggested by Dr. J. P. Michaels. Saliva was dialyzed for twenty-four hours and several drops of various sizes of the dialysate allowed to evaporate spontaneously under cover. The rate of evaporation determined, to a considerable degree, the size of the crystals, the slower the evaporation the larger and more nearly perfect the crystal. Seventy-one pictures were made with polarized light and conclusions reached as follows.

The salts that are usually crystallizable from saliva are the chlorides of sodium, potassium and ammonium. These in moderate quantities may be regarded as normal constituents. Ammonium chloride is seen most frequently and crystallizes in feathery forms (*fig. 1*). Sodium chloride (*fig. 2*) crystallizes in cubes, often occurring in cubical aggregations with hollow centers. Potassium chloride likewise crystallizes in cubes, which are prone to form characteristic dagger shaped aggregations (*fig. 3*). Large prismatic phosphates were occasionally seen and rarely crystals of sodium oxalate. Crystals resembling those of acid lactates were occasionally found and were of particular interest because, in some cases, they were separated from persistently acid salivas (*fig. 4*). Soluble oxalates were not infrequent (*fig. 5*). The crystals that were separated from urine included those mentioned above; in addition, crystals of urea and acid urates.

Under certain conditions creatinin from saliva yields crystals that closely resemble sodium oxalate (*fig. 6*).

The significance of these pictures is a matter for study and further investigation.

[1] Presented at a meeting of the Harriet Newell Lowell Society for Dental Research, at the Harvard University Dental School, May 18, 1920.

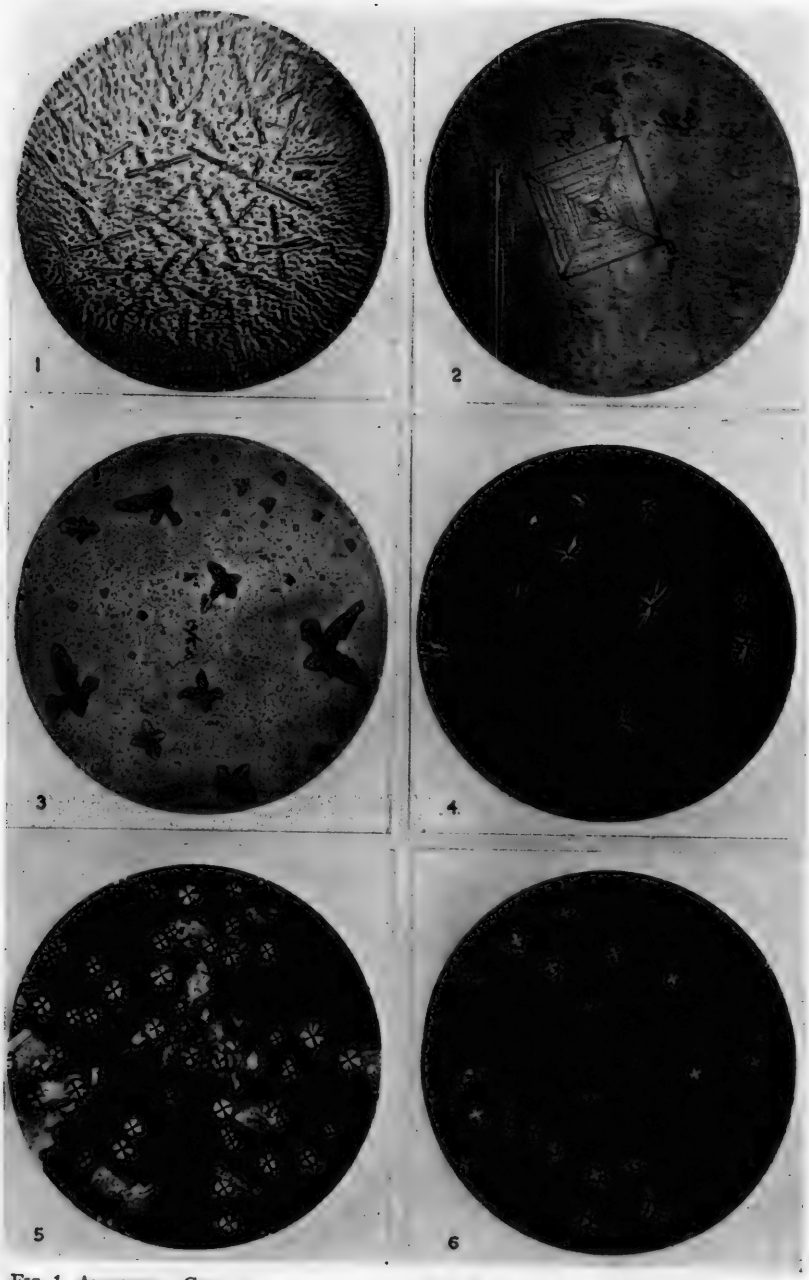

FIG. 1. AMMONIUM CHLORIDE.
FIG. 2. SODIUM CHLORIDE.
FIG. 3. POTASSIUM CHLORIDE.
FIG. 4. LACTATES.
FIG. 5. SODIUM OXALATE.
FIG. 6. CREATININ.

COMPARATIVE ABRASIVE QUALITIES OF FIVE DENTIFRICES[1]

HENRY J. CARNEY

Boston, Massachusetts

This work was done to increase the dentist's and the patient's scientific information in regard to some of the more popular dentifrices. No partiality for any particular dentifrice is intended by the writer; he wishes only to present the facts as he obtained them.

The dentifrices examined were Kolynos, Bestol, Colgate's Paste, Pepsodent and Pebeco. It was necessary, of course, to subject the samples to absolutely uniform tests as regards time, force or pressure, and rapidity of application. In order to accomplish these results, the apparatus shown in the accompanying illustrations was used.

The tests were applied to the cementum of freshly extracted teeth, which were kept moist throughout the experiment to avoid uneven drying. All the teeth were from the same patient, to ensure as far as possible equal densities of calcification to start with. The tooth was weighed in distilled water, firmly fastened to the cross-piece (*T*), brushed with the paste under consideration (*P*) for fifteen minutes, and then weighed again under the same conditions as at first. The cementum only was brushed and duplicate tests were made to ensure uniform surfaces. Freshly extracted teeth were used rather than ivory or bone, since teeth present the conditions actually involved in the inquiry. The results are recorded below:

DENTIFRICE	WEIGHT OF THE TOOTH BEFORE BRUSHING	WEIGHT OF THE TOOTH AFTER BRUSHING	LOSS IN WEIGHT	
	mgm.	*mgm.*	*mgm.*	*per cent*
Kolynos	767.2	766.5	0.7	0.09
Bestol	635.1	633.5	1.6	0.25
Colgate's	639.2	634.4	4.8	0.75
Pepsodent	606.2	594.1	12.1	2.00
Pebeco	945.0	928.1	16.9	1.79

[1] Presented at a meeting of the Harriet Newell Lowell Society for Dental Research, at the Harvard University Dental School, May 19, 1921.

Before taking up this study it was thought advisable to obtain opinions from the several manufacturers concerning this subject. The quotations below are excerpts from the letters received from them. It may be interesting to compare their statements with the facts as obtained in our laboratory.

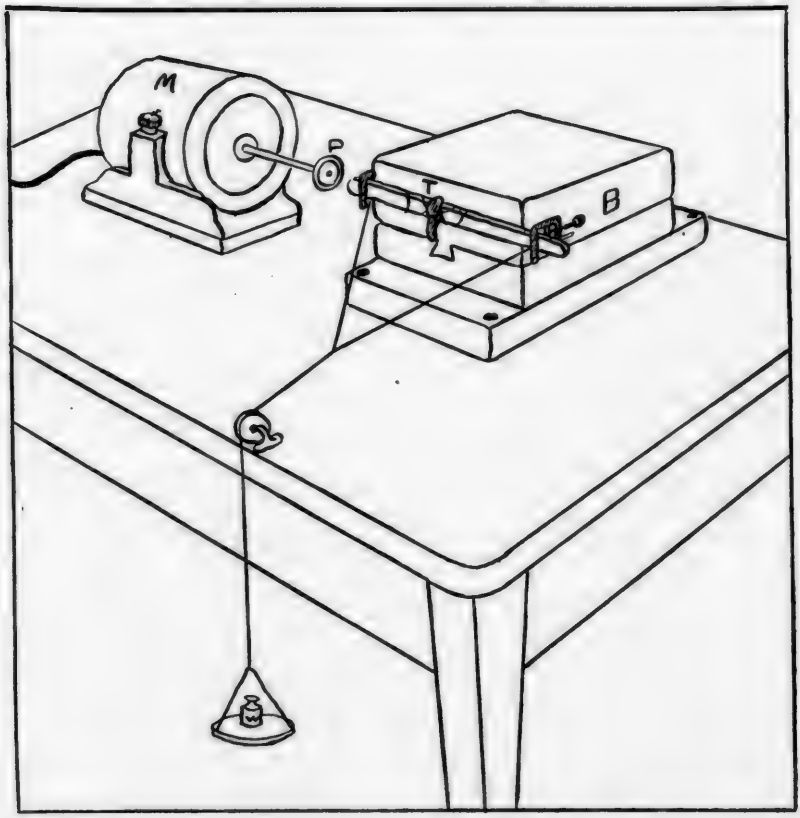

FIG. 1. DIAGRAM OF THE APPARATUS USED IN THE TESTS.

In making the tests, the two parts of the apparatus were brought together so that the tooth (T) was directly behind and in contact with the brush (P). The weight (W) attached to the sliding block (B) maintained a constant pressure of the tooth against the brush, which consisted of a felt cone that was revolved rapidly by the motor (M).

Kolynos Company. "Should you care to visit our laboratories we will be very glad to explain the methods used, and also show you the actual results of using Kolynos on ivory cylinders. On one side of these ivory

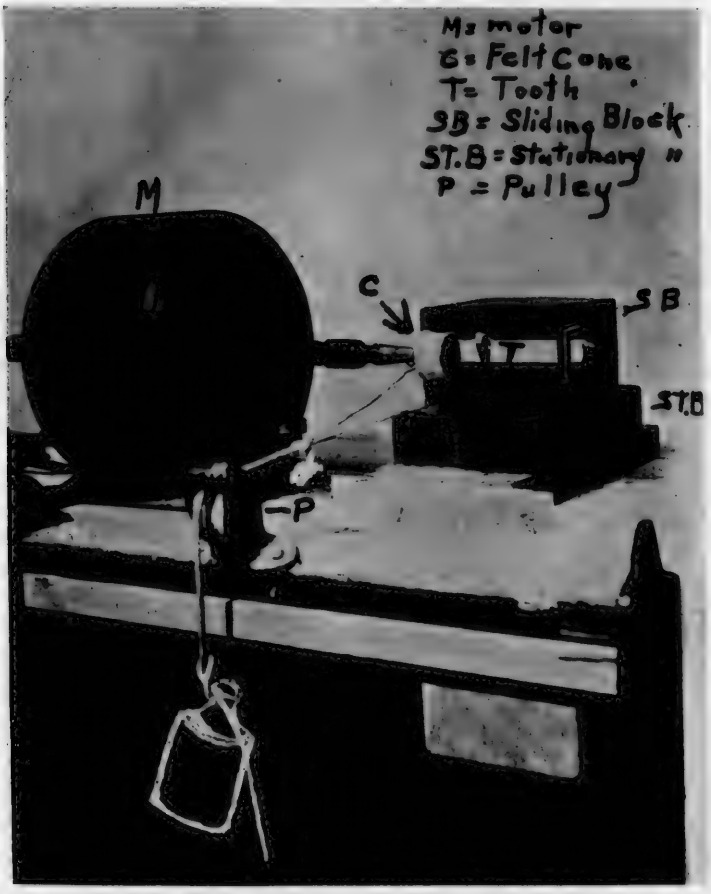

FIG. 2. PHOTOGRAPH OF THE APPARATUS SHOWN IN FIG. 1

cylinders is the abrasive action of Kolynos, and on the reverse that of any other dental cream. In all cases Kolynos showed less abrasive action than the others."

Bestol Company. "The abrasive coefficient of Bestol Dental Cream will be found to vary between 116–130 dioptometer scale, $2\frac{1}{2}$ inch brush 2000 R. P. M., impinging pressure of 50 grams."

Colgate and Company. "The chief constituent of Colgate's two dentifrices is calcium carbonate. This is a cleanser. Colgate's Ribbon Dental Cream and Dental Powder cleanse and polish without scratching."

Pepsodent Company. "Regarding the abrasive or polishing agents used in pepsodent: this is Ca_3PO_4, finely powdered and sifted through 200-mesh silk bolting cloth. Calcium phosphate (Ca_3PO_4), you know, is the substance of which enamel is composed; and the very fact that it produces a high polish is evidence that it is not harmfully abrasive."

Pebeco Tooth Paste Company. "We put the finest quality of impalpable calcium carbonate ($CaCO_3$) in our Pebeco Tooth Paste, which is absolutely free from any abrasiveness."

A RÉSUMÉ OF THE FINDINGS OF RESEARCH ON THE EVOLUTION OF DENTAL ALLOYS AND AMALGAM TECHNIQUE[1]

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I. INTRODUCTION

Previous to the years of 1875–1876, when the first organized movement was made in its favor, amalgam had been an empirical product, but, beginning in 1875–1876, alloys and the amalgams resulting from them began to acquire a more scientific aspect. In 1875–1876, dentists of the calibre of Henry S. Chase, S. B. Palmer, and J. Foster Flagg, who were prominent in the profession, organized "the new departure movement" and adopted a set of resolutions, two of which are quoted below:

"*Article I.*—In proportion as teeth need saving, gold is the worst material to use.

"*Article II.*—Amalgam, per se, is an excellent filling material."

Brave words these at a time when amalgam was the "outlaw" of all filling materials. Even those who used it in their practices hardly dared to confess it to their professional brethren.

True enough, the alloys of that period were not any too dependable and the behavior of amalgams in the mouth was capricious, but the evolution in alloys was, nevertheless, steadily progressing. Flagg, in particular, made many investigations of great value, and undoubtedly furnished a firm foundation for the next champion of this material, who was no other than that remarkable man, G. V. Black. In 1895–1896, Black took up the work where his predecessors left it. His investigations finally resulted in the deduction of a method of alloy manufacture, as well as the development

[1] Read at a meeting of the Harriet Newell Lowell Society for Dental Research, at the Harvard University Dental School, December 9, 1920.

of an amalgam technique, which provided firmer foundations on which to build the scientific data of today.

The writer of "Triology" (10) visualizes the situation very nicely when he says: "Much of the material presented by Dr. Black was not new, but it remained for his wonderful scientific mind to gather isolated facts, trace out their origin, group them together in rational form, show how they were correlated, what their effects were, how to counteract or control their injurious factors, and how to best utilize those which were helpful." His endeavors helped to place alloy manufacture and manipulation on a more scientific basis. His most important discoveries were "balancing and ageing" of an alloy. It is to him that we are indebted for the present classification of alloys, as given below.

Class 1. High-percentage silver alloys, high silver-content alloys, quick setting alloys, and Black's method alloys. These terms are synonymous and signify contents of 65 to 70 per cent of silver, 25 to 28 per cent of tin, 3 to 5 per cent of copper, and 0.5 to 2 per cent of zinc. (It is true that one or two alloys of this class contain no zinc but I shall presently show you that the quarternary alloy or alloy of four component metals is the more dependable one, and that zinc is an important metal for several reasons; also, that Dr. Black was in error in his statement that "even less than 0.5 per cent of zinc was not permissible.")

Class 2. Low-percentage silver alloys, high tin-content alloys, plastic alloys, and slow setting alloys. These terms are also synonymous and signify contents of 43 to 48 per cent of silver, 45 to 60 per cent of tin, 3 to 5 per cent of copper, and 0.5 to 2 per cent of zinc. (It was from this class of alloys, which were the legacy of Flagg to the profession, that Black evolved the alloys of the high-percentage silver type. Previous to his discovery of balancing, which we shall presently discuss, the alloys in use were rich in content of tin and were low in percentage of silver. The alloys of the low-percentage silver type are not suited for filling teeth according to recent investigations. They were not sanctioned by Black and their use is principally for the making of models for the gold inlay by the indirect method, and such other purposes as call for model alloys.)

II. MODERN POINTS OF VIEW

The foregoing remarks are, in a measure, a preamble to the discussion of more recent investigations, the primary purpose of this paper. In attempting to cover this subject in a single paper, I find myself in the dilemma which Zurbrigg well expressed when he wrote (7): "The subject

of dental alloys and their amalgams is so vast and complicated, and has so many angles, that a full discussion of what they are, what are the physical properties of each metal and the reason for its use, how made and compounded, their behavior under varied conditions of both laboratory and clinical manipulation, covers a field which would require a course, rather than the program of a single evening."

It might be of interest to discuss the physical properties of each metal, but I feel assured you are already well instructed in this particular. I shall refer to that phase of the subject only as it concerns the scope of this talk.

I have said that zinc is an important metal in a dental alloy and have, thereby, contradicted Black's statement in regard to it. This problem has not yet been solved to the satisfaction of all concerned, but I unhesitatingly favor the use of zinc, a position that is supported by the majority of investigators, professional and commercial. Opponents of the use of zinc depend entirely on Black's statement concerning it and, singularly enough, offer no *recent* data to substantiate their claims; at least no such data have been published. I do not quote Ward exactly, but he says, in the American Text Book of Operative Dentistry (6), that most manufacturers have found that, to prevent contraction, zinc is a necessary metal in a dental alloy. It is admitted by alloy manufacturers, in advocating its use, that zinc is a dangerous metal if used improperly, by which they mean if used in large proportions. I know of only one alloy, containing as much as 2 per cent of zinc, that I should class as one of the dependable alloys.

If zinc is eliminated from a dental alloy, such alloy is unfit for use if over a year old. Therefore, alloy products that do not contain zinc should be dated for the protection of the dentist. The non-zinc alloy, if over a year old, takes on many of the undesirable characteristics of the low-percentage silver alloys. A very good analogy might be drawn in regard to the dangerous qualities of zinc by comparing it to some of the vegetable alkaloids, which are virulent poisons in large doses but are the most potent tonics when used in proper amounts. It is now a pretty well known fact, according to the admission of Black himself, that the zinc used by him was obtained from commercial sources. This fact alone might easily explain his statements relative to the use of that metal, as well as his use of the Wedelstadt tube in connection with his experiments, an instrument now known to be fundamentally inadequate for such tests.

I have alluded to the discovery by Black of balancing alloys. What do we mean by a "balanced" alloy? It is one that is obtained by combining the metals composing it in such proportions as to eliminate contraction and

to control expansion in the amalgam resulting from it. A very *slight* expansion is permissible, perhaps desirable, but this is exceedingly small, amounting to 1/20,000 to 3/20,000 of an inch in an experimental specimen of certain size, and is then confined to a period which may be designated as *initial.* We shall discover, as we proceed, that modern research has evolved a method of control over this expansion. This is accomplished by varying the mercury-alloy ratio, by the type of the cut of the alloy, the duration of trituration, and the packing pressure, each of which will be discussed later.

A recent writer on this subject has said: "Balancing an alloy, then, is the controlling of the tendency of one metal to contract by that of another to expand, until a point of neutrality is found where the resulting amalgam remains practically dimensionally stable. This necessitates the possibility of a change of formula, even if slight, with a new batch of metals. The balancing process applies particularly to the silver-tin content of the alloy" (10). Balancing was accomplished by Black, therefore, by increasing the amount of silver until it neutralized the contracting tendencies of tin. To quote Ward, in substance (6): one of Dr. Black's prominent assumptions was that, in all events, there must be no contraction and his great ambition seems to have been to produce an amalgam in which there would be no movement after its insertion in the cavity. This quotation illuminates, to the careful student of the subject of alloys and amalgam (dental), many of Black's statements relative to the mercury-alloy ratio, manipulation, etc., and indicates why so many of his opinions are subject to revision on account of the use of modern instruments which are more delicate and accurate, which measure movement that former instruments would not record, and which, of course, were not available to Black.

The properties of the metals in a dental alloy, and their influences in "balancing" such an alloy, may be summarized as follows:

Silver: expansion, strength, improvement of color

Tin: contraction, plasticity, improvement of color

Copper: strength, stability

Zinc: toughness, amalgamation facilitated, improvement of color, stability

I alluded to annealing. According to some writers, Black discovered the phenomenon of "ageing." I am inclined to the opinion that Flagg deserves credit for this. In any event, this discovery was made in the accidental observation that exposure of an alloy to heat (in storage) retarded the setting of the alloy. Modern investigation, however, furnishes methods of control over this phenomenon to be discussed later. This is a matter of some disagreement, but apparently reliable data have been fur-

nished to support the above statement, and until it is disproved it seems reasonable to accept it.

It was found that the alloys of high silver content set so rapidly that the amalgam resulting from them could not be properly inserted in a cavity. This is true of that class of alloys as they are manufactured today, and they require artificial annealing to retard the setting process to the degree necessary for their proper manipulation. This rapid setting is attributed to the large amount of silver they contain, and also to the hardening caused by the process of cutting the alloy into filings (or shavings). Again I quote Ward, in substance (6): It is a well known fact that the working of metals forces their molecules into unnatural positions, and that by annealing they are largely restored to their normal state. Dr. J. Foster Flagg seems to have been the first to call attention to the fact that alloys which are freshly cut behave differently from those which have stood for some time. Dr. Black traced the phenomenon through a great number of experiments and finally arrived at the conclusion that the cut alloy is hardened by the violence of cutting, the condition thus produced being analogous to the condition of the same metals induced by hammering. After a great many experiments, it was proved that the change was brought about by annealing or "ageing," that is, by a molecular change in the cut alloy. By annealing, which is the reverse of hardening, the metal flows and this tension is relieved. . . . It has been shown that annealing has four effects on the final result. First, upon a change in volume; second, upon strength; third, upon the rate of setting; fourth, upon the percentage of mercury to make a plastic mass."

At least one of the modern investigators does not admit all these effects. Artificial annealing, to which manufacturers resort, is accomplished in several ways: under water, in steam, with dry heat in jacketed ovens—all for longer or shorter periods depending on the degree of temperature employed.

The more modern research has shown that there is a correct point and method of annealing for each individual alloy, and that an alloy can be over or under annealed. The statement has been made, and data substantiate it, that a correct method and amount of annealing will produce an alloy from which the resulting amalgam will be unvarying—an alloy that will work the same under identical conditions and produce a mix of uniform strength regardless of the age of the alloy, if it is kept reasonably free from exposure to air and not stored where it is exposed to undue heat. I have long felt assured that many manufacturers anneal their alloys to a degree that is necessary to satisfy the desire of the profession for a slower setting

product. I believe that, by so doing, they decrease the value of their product.

An important consideration, aside from the formula for the alloy, is the type of the cut and the size of the alloy particles. The alloy should be very finely cut (filings), never coarsely into shavings. The latter must be reduced to filings during the process of amalgamation, which involves a loss of time. More important reasons for the finer state of division are the possibilities of greater surface oxidation during the process of manufacture, and also in the package and in handling. Reducing the size of the alloy particles results in facilitating amalgamation, in a more perfect solution of the alloy, in a smoother and more velvety mix, and in hastening volume changes during amalgamation and hardening, a most desirable feature for it contributes to earlier stability of the filling.

The foregoing covers the field I wish to discuss at this time so far as the details of manufacture are concerned. Our next consideration will be the effects of manipulation.

I have said that "so far as manufacturing was concerned, there have been fewer changes from Black's methods than in manipulation." However, I wish again to emphasize the statement that the few changes in that particular from Black's methods play an important part in the evolution of alloys and the amalgam technique, even if they appear trivial. Much progress has been made since the appearance of Black's articles in the *Dental Cosmos* (1895–1896) in respect to manipulation, and this evolution has been greatly assisted by the fact that instruments are now available that are much more sensitive and accurate than those he used.

III. RESULTS OF RECENT RESEARCHES

The most important investigations of recent date have been conducted by Arthur W. Gray, at the L. D. Caulk Company's Laboratories, Milford, Delaware, and by the United States Bureau of Standards, Washington, D. C. These investigations have been conducted along scientific lines with the aid of modern instruments and have yielded much interesting data. They agree in the main so far as their conclusions have been published. Many of us, who are interested in the research aspect of alloys and their amalgams, have been disappointed in the articles on this subject in the recent edition of the American Text Book of Operative Dentistry. We had hoped that Editor Ward was conducting investigations of this subject that would lead him to offer more definite statements than his article on amalgam contains. The article gives a wealth of information on this subject from every angle except that of the modern researches.

Ward has evidently reviewed the investigations referred to and gives a few of Gray's charts, but has evaded the real issue regarding them.

In considering the results of the recent investigations I shall discuss the influence of variations in the mercury-alloy ratio, the influence of the size of the alloy particles, the influence of trituration time, and the influence of packing pressures. The influence of annealing has already been discussed.

In a recent issue of the *Journal of the National Dental Association*, Guy S. Millberry (4), discussing the recent investigations referred to above, wrote, in substance, as follows: The things which are most helpful to us as practising dentists, expressed in terms of common understanding, are that practically all previous tests on crushing strength have been inaccurate because of the small dimensions of the cubes tested, the type of the apparatus used, and the absence of temperature control and regulation. In his experiments, Gray used a 9000 kgm. testing machine, which he modified by the addition of an electric motor drive which applied the load with regularity, and by the addition of electric heaters for bringing the specimen under test to the desired temperature, which was determined by a suitably placed thermo-element.

The test specimens in Gray's experiments, to which Millberry alluded, were 10 mm. in height and 10 mm. in diameter, and were prepared by molding the freshly mixed amalgam in a thick-walled steel tube, the interior of which was highly polished. A measured force, applied by the testing machine and maintained for a measured time, was used in packing the amalgam between an accurately fitting piston and the removal bottom of the mold. This packing squeezed out the excess of mercury and condensed the plastic mass into a firm smooth cylinder with parallel ends. The procedure secured both uniformity of cross-section and uniformity of packing conditions. In hand-packed specimens there would be great variations in crushing strength but specimen cylinders formed by the above methods would insure comparative results. In some of these tests, the pressure under which the amalgam was condensed varied from 25 to 3200 kg. and the packing pressure also was maintained from 1 to 16 minutes. Gray's experiments resulted in his discovery of a very important law connecting the crushing strength of an amalgam with the pressure employed in packing it. This has been termed the "logarithmic law" (9). As I understand one phase of its interpretation, given the pressure under which a cylinder is packed and its temperature at the time of its being tested, a logarithm can be plotted on a chart and the crushing point of the specimen will follow this logarithm consistently. This, of course, verifies the law. From this law, it also follows that every doubling of the packing pressure is accompanied by the same increase of strength.

In the experiments conducted by the United States Bureau of Standards (5), "the amalgamation and condensation procedure (unless otherwise specified) was according to manufacturers' instructions. . . . . The artificial or matrix cavities were holes in steel blocks drilled and polished. The amalgam was condensed in these, using three or four different-sized pluggers. Those specimens which failed to show perfect adaptation to the form were rejected." These specimens were hand packed, 1 cm. in length and 6 mm. in diameter. As I understand the report, an interferometer instead of an Olsen machine was used in making the tests for crushing strength.

With these explanatory remarks, let us consider the five points mentioned above. When each of these factors was varied in Gray's experiments, the other factors remained constant. Each of the factors, in its turn, was varied individually until the ultimate finding, which yielded the best results, was a conglomerate of each individual factor in relation to the group of factors.

a. It was found by the investigators that the *mercury-alloy ratio* had an important influence on the resulting amalgam. Different proportions of mercury and alloy were carefully tested and, to quote Gray, it was found that approximately five parts of alloy by weight to eight parts of mercury by weight yielded the best results for strength and thorough amalgamation with the particular alloy tested. This is sometimes expressed as a mercury-alloy ratio of 1.6. Even ten parts of mercury can be used without loss of strength (1). In conjunction with a more prolonged trituration time than has been commonly practised, the liberal use of mercury was found to exert an important effect on volume changes, that is, they took place mainly during the period of amalgamation; and when the amalgam was placed in the cavity it was practically a stable product (relatively speaking). This liberal mercury-alloy ratio also serves to facilitate amalgamation and makes for a more thorough mix—a result we should strive to attain by any legitimate means in the operative procedure.

b. I stated before that the *size and shape of the alloy particles* are also involved in attainment of the results enumerated in the foregoing discussion of the mercury-alloy ratio. "As the alloy particles become progressively smaller, the reaction curve shows the same results as those that follow increasing the mercury-alloy ratio and the trituration time, as well as he same control of initial volume changes" (1). This hastens final stability.

c. "Increase of *trituration time*, in the presence of the liberal mercury-alloy ratio above noted, is accompanied by a progressive increase of strength until the maximum is reached when trituration is maintained for about

six minutes. The experimental specimens that were used to obtain the above data were made from a 6 gm. mix" (1). A smaller mix would require a shorter trituration time. It was found, however, that so slight a gain of strength results from triturating longer than five minutes that the limits for this procedure are placed at from three to five minutes according to the size of the mix. After six minutes of trituration there is a partial setting of the amalgam, showing that, in the operative procedure, a vigorous and thorough amalgamation with a suitable mortar and pestle is highly desirable and should be maintained for from three to five minutes. Emphasis should be laid on use of a mortar and pestle—I do not believe that the palm of the hand is adapted for this purpose. The manner of trituration is important also—it should be conducted vigorously, for it may be stated as a law that any procedure that insures closer union of the mercury and alloy results in a stronger and more thoroughly dissolved product, accelerates the action, and shortens the time required for the filling to reach its final stable condition.

It is for this reason that I am a thorough advocate of a suitable mechanical mixer. I say "suitable," for many of the mechanical mixers are worthless. Speaking of the types with which I am familiar, I place their value in the following order: Rex, Caulk, Sibley. If you will permit me to continue to be personal, for I have made a study of this feature from the standpoint of operative procedure, I believe that the problem of proper mixing presents quite a field of investigation for the scientific laboratory and one which might wisely be developed as the next step in the improvement of the amalgam technique. I have insistently made this contention with some small results and, until it is proved that I am incorrect, I shall continue to be an enthusiastic advocate of mechanical mixing. I am convinced that thorough amalgamation is accomplished much more quickly with the use of the mechanical mixer. I have the temerity to state, without any scientific data to support me, however, that a three-minute mix in a suitable mechanical mixer will accomplish the same result as a six-minute mix in a hand mortar, which you remember gives the maximum strength without the danger of incipient setting of the amalgam. Therefore, by deduction, not from scientific investigation, I believe that the six-minute limit is one of time rather than a limit placed by completeness of the solution of the alloy in the mercury. At the risk of appearing ridiculous, I shall hold to this belief until scientific data discredit the assumption.

Before leaving the subject of trituration, I wish to call your attention to the effects of insufficient trituration. Insufficient trituration-time results in the production of a granular mass of less strength, with a color

that is not so pleasing and which I designate as a battle-ship gray. A more important result is the fact that the alloy particles are not thoroughly impregnated with the mercury and much excess of mercury is retained *among* the alloy particles, a condition that is conducive to volume changes over a long period after the filling has been placed in the cavity. In contradistinction, under properly prolonged trituration, more mercury is retained or contained in the *mass*, but not between the alloy particles, for the alloy is in more perfect *solution*, and the excess of mercury in the latter instance is capable of being expressed under heavy packing pressure, without danger of expressing an undue amount of tin and thus upsetting the balance of the alloy.

d. That the manner of packing (*packing pressure*) is of great importance, in the operative procedure, has been shown admirably by Harper (2, 3) whose technique in this particular I unhesitatingly recommend. The greater the pressure applied in packing or condensing a filling, the smaller the mercury content in the finished filling and the greater the strength of the filling. The strength of the filling and the mercury content are always in inverse ratio to each other. I hinted at this in my reference to the "logarithmic law" (1).

Gray observed that, under a given or constant packing pressure, "constant mercury content is reached before constant strength, when the mercury-alloy ratio is progressively increased" (1). Gray has also shown conclusively that dimensional changes in an amalgam can be altered at will, that is, variable results can be secured by varying the mercury-alloy ratio, or the trituration time, or by modifying packing pressures (1). This controverts Black's statements that shrinkage and expansion are not under the control of the operator but wholly under that of the manufacturer and are determined entirely by the composition of the alloy.

In contradicting, as I have in this discussion, many of Black's statements, I do not wish to be misunderstood as discrediting the man who was one of the most broadly educated dentists the world has ever known. Black gave us many ideas which, true to his own prophecy, have yielded to the ever progressing law of evolution. Had he possessed the instruments now available, who can say his investigations would not have yielded different results?

IV. PRACTICAL APPLICATIONS

The practical application of the foregoing, from the standpoint of the operative procedure, may be briefly expressed as follows:

a. We must use one of the high silver-content alloys and one that is manufactured by a reliable firm.

b. The alloy must be finely cut.

c. The alloy must be properly annealed.

d. We must use a "liberal quantity of mercury"—not less than eight parts of mercury to five of alloy by weight. More will do no harm but is a waste and develops a "sloppy mix."

e. We must triturate the mass vigorously from three to five minutes in a hand mortar (personally, I say, with a mechanical mixer of approved pattern).

f. We must condense or pack the amalgam with as much force as possible, using smooth faced pluggers, carefully stopping the same, and removing the excess of mercury and fluid amalgam from the cavity as we pack layer after layer.

g. We must pack the cavity with a generous overplus.

h. We must use a matrix when a wall or walls are missing.

i. We must properly restore the mass and form of the tooth in all its details.

j. We must properly finish and polish the filling.

There is yet a wide field for investigation of amalgam. Ward believes that chemical compounds exist in them but with feeble affinities. The surface of the truth in this field has been barely scratched but a great opportunity awaits the mind that is properly trained to investigate it thoroughly.

I cannot forbear to remark that it is unfortunate that so great a majority of dentists regard amalgam as a plastic that can be properly handled without any particular skill, and make no endeavor to improve their technique. That Black held an entirely different view is evidenced from the following comment in his work on Operative Dentistry (6): "Fillings made of modern amalgams are a close second to gold in their durability and protection to the teeth. The difference is that *amalgam is the more difficult to make perfectly. It is more difficult to learn the manipulation and even then is more difficult to secure perfect results, filling after filling.*"

As Millberry aptly says (4): "Operative procedure on our part should be developed to such a degree that the combined results of skilful effort and dependable material will benefit humanity."

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A BRIEF HISTORY OF PERIODONTOLOGY[1]

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New York City

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I. INTRODUCTION

Diseases of the periodontium are as old as recorded history. Frequent mention is made by ancient writers of "loose teeth," "shaking teeth," "hemorrhage of the gums," etc. In the Ebers papyrus, which dates from the thirty-seventh century, B.C., certain remedies are prescribed "to strengthen the gums" (13). There is abundant evidence that such diseases were prevalent among the early Greeks, Phoenicians, Etruscans, Hebrews, Chinese and Romans. The frequent allusions, among the writings of these early peoples, to "loose teeth" and "bleeding gums" with their discharge of "corruption," all point to the fact that periodontoclasia was a not uncommon disease in remote times, and that it expressed itself in a pathology not unlike that of the present.

What was true of ancient peoples was also true of those of the middle ages: from the days of Celsus, whose writings date from the first century of the Christian era, to the birth of American dentistry, references to "loose teeth" and their sequelae are made with increasing frequency (5).

Theories also prevailed regarding causes. Galen, a writer of the second century, states that it is caused by a "relaxation of the dental nerve, due to an excessive abundance of humors" (13). More than a thousand years later, Guy de Chauliac, the greatest surgeon of the middle ages, expressed the belief that "loose teeth" had a variety of causes, such as "humidity

[1] Read at a meeting of the American Academy of Periodontology, New York City, May 10, 1921.

which softens the nerve and ligament; dryness and lack of nourishment of the teeth, and corrosion of the gums." Certain forms of the disease he believed to be incurable.

Fauchard (13), who has been called the father of modern dentistry, writing in 1723, says that "little or no care as to the cleanliness of the teeth is ordinarily the cause of all the maladies that destroy them"—one of the earliest expressions in recorded history of the importance of oral hygiene in the prevention of dental disease.

Some form of palliative treatment for "loose teeth" has been recommended from earliest times, notwithstanding the fact that the disease was generally regarded as incurable. Mouth washes, usually of a most absurd nature, were prescribed as affording some relief. Even as late as the days of Fauchard, human urine was recommended, and judging from ancient writings seems to have been a favorite mouth wash for more than two thousand years.

When one comes to a study of the history of American dentistry, it will be noted that a disease which caused loosening of the teeth, and which was frequently referred to as "scurvy of the gums," was commonly seen by the early practitioners. It was regarded by them as an incurable disease of constitutional origin, more or less inevitable in adult life. Hence little attention was paid to it, and people continued losing their teeth as they had done from the beginning of recorded history. The disease remained what it had always been, a disease of mystery; but the dawn of a better day was at hand. The theories which had encumbered it for centuries were swept aside. The assertion was made that the disease was of local origin, and could be cured by local treatment. Moreover, it was asserted that treatment was surgical and not therapeutic (33). This was a long step in advance, for up to that time the disease, which caused loosening of the teeth and which was known by various names, had been regarded as incurable; and dependence had been placed upon therapeutics in an attempt to arrest its progress. The man who wrought this change, and to whom all humanity is indebted for the control and cure of one of the most common diseases of adult life, was John M. Riggs of Hartford, Conn., the father of modern periodontia, and one of the greatest names in American dentistry.

II. THE WORK AND CAREER OF JOHN M. RIGGS

Riggs was born in Seymour, Connecticut, October 25, 1810. His family was anxious that he should enter the ministry, and he was accordingly sent to Trinity College, Hartford, where he was graduated in 1837. It is reported that at the commencement exercises, the baccalaureate sermon

was preached by one of the bishops of the church on the subject of the Trinity; at its conclusion, Riggs, who was greatly agitated, went to the bishop and said: "I believe in one God, and in one God only. I do not believe in a bouquet of Gods, and I'll be damned if I'll ever preach any such doctrine." Thus the church's loss was dentistry's gain.

After graduation Riggs matriculated at a medical school and studied medicine for one year, when he took up the study of dentistry under a preceptor, as was the custom in those days, and began practice in Hartford in 1840. Riggs was a close friend of Horace Wells, the discoverer of anesthesia, also of Hartford. When, on December 18, 1844, Wells saw an exhibition in that city of the properties of laughing gas, he was so impressed with its possibilities as an obtundent of pain in surgical operations, that the following day he invited Riggs to his office, and requested him to extract one of his teeth while he, Wells, was under the influence of the gas. This was done, Wells declaring that he had suffered no pain in the operation, thus giving to Riggs the distinction of having performed the first surgical operation on record under anesthesia. Riggs had not been long in practice when he became interested in what was then referred to as "scurvy of the gums," a disease characterized by loosening of the teeth and discharge of pus from their alveoli. He made a lifelong clinical study of the disease and came to the conclusion that the various phenomena attending its progress, from its earliest manifestations in a marginal gingivitis, to the final exfoliation of the teeth, were all different expressions or stages of the same disease, which he classified into four types corresponding to the advancement made by it in any given case (33).

Riggs was a retiring and modest man. He was an irregular attendant at dental society meetings, and an infrequent speaker when present, for which he was sometimes criticised by his contemporaries; as he also was for allowing the disease to be called by his name. Riggs publicly disclaimed ever having originated the name or ever having used it himself, saying it had been called "Riggs' disease" by some of his disciples, which is abundantly proved by the literature of that time.

Riggs seems to have written only two articles on the subject: one entitled "suppurative inflammation and absorption of the gums" (33); the other, "pyorrhea alveolaris" (34). Only the first was published in full. His fame, however, was not limited to New England or even to America; in Europe, his name became well known and he was given credit for being the first successfully to treat the disease and to invent instruments by which it could be cured by any one who acquired the technique. There was then, as now, a division of opinion regarding the effects of treatment, some de-

claring that though its progress might be inhibited, it could not be cured; while on the other hand, Riggs claimed he could cure 90 per cent of the cases under his treatment, which claim was also made for him by some of his followers (23).

At a meeting of the Connecticut Valley Dental Association, held at Greenfield, Massachusetts, June 10 and 11, 1869, the following resolutions were passed giving credit to Riggs for "originating and first publicly describing a new treatment for the cure of inflammation of the gum," etc., as follows:

Whereas, the credit for originality in surgery is always conceded to the one who first publicly announces a new operation, applicance, or method of treatment: therefore be it

Resolved, That, in the judgment of the Connecticut Valley Dental Association, the credit of originating and first publicly describing a new treatment for the cure of inflammation of the gums and absorption of the alveolar process, or the so-called "scurvy of the gums," thereby saving and restoring to comparative firmness the loosened teeth, is due to Dr. J. M. Riggs of Hartford, Connecticut, he having detailed his method of operating to this Society years ago, and illustrated it, at the request of the Society, by a clinic upon Dr. E. M. Goodrich, of Westfield, Massachusetts, at our meeting at Northampton, in June, 1867. He also operated in Boston, in August, 1866, with acknowledged success, upon Dr. D. K. Hitchcock; and be it

Resolved. That this resolution be forwarded to the journals for publication.

The treatment above referred to, by which so-called "scurvy of the gums" could be cured, consisted in a removal of the calculary deposits upon the roots of the affected teeth and a rather thorough curettage of the margins of the alveolar process. It has been stated that it also included an excision of the gum tissues, level with the absorbed alveolar process, but there is no mention of any such treatment ever having been advocated by Riggs or his followers. On the contrary he is on record as calling such methods "barbarous." Thorough curettement of the alveolar process formed a prominent feature in the treatment and, as practised by Riggs, made of it an heroic operation (37). Dr. Levi C. Taylor, who was associated with Riggs for two years, says, in a personal letter to the author: "Dr. Riggs was very rough and seemingly harsh but for all that, he produced the best results I have ever seen and especially so in bad cases. He would place his patients in some instances under chloroform far enough to do his work satisfactorily. The results were always good." For his work Riggs devised his own instruments. These were six in number, the first four being in rights and lefts and, as compared with present day requirements, they were crude and clumsy.

Cleansing and polishing of the teeth after treatment were advocated, followed by careful attention to oral hygiene by the patient. Riggs depre-

cated the use of drugs, claiming that the operation was a surgical one, and that, when thoroughly performed, all other treatment was unnecessary.

For more than forty years Riggs practised and taught the surgical treatment of suppurative periodontoclasia, and achieved a large measure of success. Patients came to him from long distances for treatment, so well known had he become.

His colleagues were unanimous in giving him credit for originality and skill in his specialty. In 1876, the Baltimore Dental College conferred upon him the honorary degree of Doctor of Dental Surgery in recognition of his outstanding achievements. He was for several years clinical instructor at the Harvard Dental School. In 1881, he attended the meeting of the International Medical Congress, in London, where he met and discussed his method of treatment with such men as Magitot, Arkovy and Tomes. He died in Hartford, November 11, 1885, in his seventy-sixth year (43). He was never married.

Too much credit cannot be given to Riggs for his epochmaking contributions: he may in very truth be called the "Father of Periodontology."

III. HISTORY OF THE TERM PYORRHEA ALVEOLARIS

At a meeting of the American Dental Association, held in Chicago in August, 1877, Dr. F. H. Rehwinkel read a paper entitled "pyorrhea alveolaris" and has been given credit for originating this term as descriptive of the disease (30). This is probably incorrect as the name seems to have been in rather general use among European writers prior to its use by Rehwinkel, a fact of which Rehwinkel was undoubtedly aware (18). Rehwinkel was born in Germany, June 15, 1825, where he was graduated in medicine. He emigrated to this country in 1848 or 1849 and, becoming interested in the practice of dentistry, was graduated from the Baltimore College of Dental Surgery in 1854 (44). He took an active part in the proceedings of dental societies and, at the meeting at which he read his paper in 1877, was elected president of the American Dental Association. He died June 8, 1889.

Rehwinkle's paper, of which only an abstract was published, shows wide familiarity with the work of foreign writers, from whom he doubtless borrowed the term pyorrhea alveolaris. This name, which has clung to the disease for nearly half a century, has been vigorously assailed from the first for its inappropriateness, both abroad and in this country. Even at the meeting in 1877, at which the name was first used in this country, it was criticised as being unsuitable. Nevertheless it has continued to be

the name by which the disease has been most widely known, possibly from the fact that the term represented the first attempt to give the disease a name suggestive of its pathology, or because a more acceptable name was not forthcoming. Following its introduction, the term Riggs' disease gradually disappeared from current dental literature.

Rehwinkel's claim to distinction in periodontia is due to his having been the first in this country to apply to this disease the name of pyorrhea alveolaris. This distinction has been further increased by the rather general erroneous belief that he originated the term. There is no evidence that he was especially interested in periodontia, or that he ever mastered the technique of treatment, though he speaks of having used Riggs' instruments with some success.

IV. AN ERA OF DISCORDANT VIEWS AND EFFORTS

Following the death of Riggs and his immediate followers, none of whom achieved distinction, periodontia again fell into the slough of speculation and empiricism. There had arisen three conflicting schools of thought regarding its etiology (16), which, with certain modifications, have existed to the present, one claiming for it a (*a*) constitutional origin, another being equally positive that it was due to (*b*) bacterial infection, and still another believing it was occasioned by (*c*) local conditions and was more or less independent of external causes. All kinds of theories were rife and found their way into the literature of the day, by way of the proceedings of dental societies. There were those who held that the disease was hereditary (26), that it was the local expression of systemic disease (31), that it was a form of catarrh (26), that it was infectious (14), that it was caused by uric acid (9, 11, 27, 28). Each theory seems to have had its followers and all were pretty much agreed that the disease was incurable. The lessons taught by Riggs were temporarily ignored or forgotten.

Some ineffective attempts at local treatment were made but dependence was largely placed on drugs, acids and certain antiseptics seeming to be the favorities. The rank and file of the profession apparently paid little attention to its treatment; people retained their teeth until they became so loose as to cause annoyance, when they were extracted. The dental schools were equally indifferent.

As an example of the extremes to which some of the theories ran, consider the uric acid theory, which had a large following and which flourished in comparatively recent times. It was claimed that, under certain conditions, calcium salts were held in suspension in the blood because of its alkalinity and were deposited in the dento-alveolar joint, in the form of

calcium urates, because of the relative acidity of these tissues, this latter condition being the result of over use (11). The calculary deposit was likened to the tophus in gouty joints (6). Theories of this kind sounded plausible to those who were more or less ignorant of the truth, and were quite generally believed by the profession.

Here and there a few voices were raised in protest to assert that the disease could be cured and to advocate surgical measures, but their number was small. One whose name is worthy of special mention in this connection is that of Dr. R. B. Adair, of Atlanta, Georgia, who began the practice of dentistry in 1868 and is still in active practice. For more than half a century, Doctor Adair has consistently maintained the essential correctness of the principles laid down by Riggs, thus making him one of the beacon lights in the early history of modern periodontology.

Another striking example is that of Dr. Wm. J. Younger, author of an article not only confirming the contentions of Riggs and his followers as to the curability of suppurative periodontoclasia, but going a step further and positively asserting, for the first time, that as a result of proper surgical treatment reconstruction of such a nature took place as to bring about obliteration of pockets and reattachment of tissues. In a paper read before the Second District Dental Society of New York, on December 12, 1892, Dr. Younger made the following statement (3):

> The treatment of pyorrhea alveolaris by the method recommended by myself to you several years ago is meeting with unabated success in my hands. Teeth hanging by apical attachment only have been rendered firm, and the tissues of the diminished sockets made so to contract and unite with the roots that an instrument could not be introduced between them without force, and causing pain and bleeding. I am satisfied that attachment takes place in these cases, otherwise the teeth could not become so firm and the gums and tissues of the socket cling so to the tissues of the root. It is therefore an easy matter for direct union to be established between these healthy, living tissues, when the partition of calculus is thoroughly removed from the root, and a granulating surface produced in the environing soft tissues of the gingivus.

To Dr. Younger, therefore, would seem to be due the credit for taking up the work begun by Doctor Riggs, and for carrying it to its logical conclusion. Like Riggs, he depended upon surgical measures for success. He followed the principles laid down by Riggs but his technique was more refined and he placed less emphasis on curettage of the alveolar process. He also devised the instruments he used in treatment, many of which have never been improved upon and are now in general use among periodontists. Younger was emphatic in claiming that the *sine qua non* of successful treatment was *complete* removal of all calculary deposits upon the surface of the

exposed pericementum (40). He was equally convinced that the disease was of purely local origin, and based his contention upon the fact that he could cure, as he said, "twenty-four out of twenty-five cases" by local treatment only. He advocated the use of pure lactic acid to be injected into the pockets following treatment (41), a procedure that has never been generally adopted in periodontia.

Younger occupies an unique place in periodontia for having been the first to claim (and to emphasize on all occasions) that an actual reattachment took place between the cementum and the surrounding vascular tissues, completely obliterating all pockets. This was denied by certain members of the profession, and even to this day there are those who profess to believe that such reattachment is impossible (4).

V. RECENT DEVELOPMENTS

Doctor Younger had his personal followers, but the rank and file of the profession were seemingly uninfluenced by the splendid work done by him in the field of periodontology. His claims of cure, including reattachment, fell on incredulous ears: theories continued to multiply, and short cuts and easy methods of treatment were sought for. With the introduction of cataphoresis, great claims were made for it in the treatment of suppurative periodontoclasia. The same was true of the roentgen ray. It had its advocates, as is abundantly proved by a review of the literature of twenty years ago. They had their day and passed away.

Another fad was vaccine therapy (15). This lasted for nearly a decade: there was something about it that appealed to the imagination. It was so much more "scientific" to inject bacterial vaccines into the patient's arm than to follow the difficult and painstaking technique laid down by Riggs and Younger. It was also easier. Moreover it was more impressive to the patient. Some of the most enthusiastic advocates of vaccine therapy in the treatment of so-called pyorrhea alveolaris were physicians with no clinical knowledge whatever of the disease they attempted to treat (20). They were loud in their praise of its value, but it also went the way of other short cuts to success in treatment and its use has been discontinued (21, 22).

In 1914 the statement was made that so-called pyorrhea was caused by endameba and could be cured by the hypodermic administration of emetin, a well-known amebacide (2, 36). Of all the "get well quick" cures this was the most widely advertised and the one that appealed most to the popular imagination. The lay press heralded the discovery from ocean to ocean. Medical men indorsed these views and undertook the emetin treatment of

patients suspected of having pyorrhea. Lengthy articles appeared in the medical press and even books were written on the subject by medical men. The rank and file of the dental profession, impressed by these claims, undertook the treatment of suppurative periodontoclasia by this new and easy method. As might be expected by any one familiar with its etiology and pathology, inevitable failure was their reward. The lessons taught by Riggs more than half a century ago, that treatment was surgical rather than therapeutic, had not yet been learned.

The succinimide of mercury treatment, the next to make its appearance in the evolution of fad treatments, was short lived and never came into general use (38). It may almost be said to have been still-born.

Finally, however, another step forward in the evolution of periodontia was taken through the growing knowledge of the part played by occlusion in the etiology and treatment of periodontal diseases. There had been those who believed, and taught, that in some way malocclusion was associated as a causative factor in periodontal disturbances, but no definite idea regarding its pathology had ever been formulated. One of the most valuable of the early contributions on this phase of the subject, and one which is almost prophetic in its nature, is an article entitled "pyorrhea alveolaris and malocclusion," published by Quedenfeldt, in 1908, in which he sets forth at some length the exceedingly important rôle played by occlusion in the etiology of periodontoclasia (29). However, his seems to have been a voice crying in the wilderness, for little attention was paid to his teachings, which appear to have been in advance of his time. More recent observers had noted that normal occlusion, orthodontically speaking, might under certain conditions be productive of disturbances in the investing tissues of the teeth. It was believed, by them, that such disturbances were caused through lack of harmony in the inclined planes of opposing teeth when brought into occlusion in the act of mastication (35). The result, in their opinion, was an undue strain communicated to the supporting structures of the teeth, causing certain definite changes in these tissues, which must be recognized as important factors in the etiology and pathology of periodontoclasia. It was believed that this was caused, not so much by orthodontic malocclusion, though that might be a factor, as by inharmonious occlusal relationship of such a nature as actually to produce injury to the supporting tissues of the teeth. This type of occlusion has been appropriately called "traumatic occlusion" by Dr. Paul R. Stillman, of New York, to whom, more than to any other individual, periodontia is indebted for correctly defining and teaching the rôle played by occlusion in the development of periodontal diseases.

It may not be wholly inappropriate at this point to pause long enough to call attention to the danger, which at present exists, in ascribing too large a place to traumatic occlusion in the etiology of periodontal lesions—in giving to it, as is frequently done, first place among causative agents, forgetting that in many instances, perhaps in the majority, it is a result rather than a cause of disease.

Further advance has also been made in correlating and arranging in logical sequence, the etiological factors in periodontoclasia (19).[2] This has been of great service to periodontia in clearing up the uncertainties of causation and in contributing to success in treatment. Credit for this achievement is due to Dr. John Oppie McCall, of Buffalo, N. Y

VI. ORGANIZATION AND DEVELOPMENT OF THE AMERICAN ACADEMY OF PERIODONTOLOGY

Meanwhile, there had arisen in this country a considerable number of dentists, who had mastered the technique of the surgical treatment of periodontoclasia, and whose success had been such as to compel general recognition. The demands upon their time were such that specialization in many instances became necessary. Thus a new specialty, which came to be known as periodontia, had its birth. Recognizing the growing importance of periodontia as a specialty in dentistry, and the need for closer cooperation and study among those engaged in its practice, Dr. John Oppie McCall, of Buffalo, with the coöperation of Dr. Grace Rogers Spalding, of Detroit, called together a committee on organization, which met in Cleveland, February 21, 1914, for the purpose of forming a national organization. The following preamble setting forth the proposed purpose of the organization was adopted at the meeting.

Whereas, The progress recently made in the prevention of dental caries and the prevention and cure of so-called pyorrhea alveolaris, has reached a point where definite and favorable results are known to be attainable; and these results are of great benefit and importance to the public; and

Whereas, The failure successfully to combat these lesions for many years past has rendered the general dental profession skeptical as to the results attainable by methods now being advocated; and

Whereas, Experience has shown that the necessary skill in diagnosis and treatment of periodontal disease may best be acquired by the specialist; and

Whereas, The existing dental societies do not afford to dental practitioners a sufficient opportunity for the free interchange of ideas whereby the science and art of these branches may best be advanced;

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[2] See also McCall: *Journal of Dental Research*, 1921, iii; proceedings, lix.

We, the undersigned, do hereby deem it for the best interests of the public and the profession that a society should be formed, to the end that those especially interested may meet and work together without prejudice for the scientific investigation of caries and periodontoclasia; that the practice of oral prophylaxis and periodontia as an exclusive specialty may be encouraged; and that the general profession may be made fully acquainted with the results that can now be obtained. We furthermore declare our intention of forming such a society and accordingly submit the following Constitution and By-Laws for adoption at the first meeting, to be called at Cleveland, Ohio, May 23, 1914. We furthermore, each and severally, agree not to accept any office during the first year of the organization, except as provided in Article V, Section 2, of the Constitution.

(Signed) GRACE ROGERS SPALDING, Detroit, Mich.
GILLETTE HAYDEN, Columbus, Ohio.
C. M. GEARHART, Washington, D. C.
J. W. JUNGMAN, Cleveland, Ohio.
J. H. HOOD, Cleveland, Ohio.
A. C. HAMM, Denver, Colorado.
J. O. MCCALL, Buffalo, N. Y., *Chairman.*

A call was subsequently issued to the then recognized specialists in periodontia and oral prophylaxis to meet at Cleveland, May 23, 1914. At this meeting, a national organization was formed, to be known as the American Academy of Periodontology, and the following officers elected: *President*, Austin F. James, Chicago, Ill; *first vice-president*, R. G. Hutchinson, New York City (refused to serve); *secretary*, Charles P. Wood; *treasurer*, Mary E. Alleyne.

The organization has met annually since its formation and has done much to place periodontology on a scientific basis. Any one specializing in periodontia is eligible to membership, which is by invitation.

VII. CONCLUDING REMARKS

The future of periodontia seems assured. It deals with that which is most fundamental in dentistry—the health of the supporting tissues of the teeth. Dental art has achieved the acme of perfection, but no art will avail for long, when applied to teeth the investing tissues of which are involved in disease, a fact which has too long been overlooked. Health and cleanliness of the entire oral cavity must be the first concern of the dental practitioner, must precede and prepare the way for every form of dental art; and this is what is meant by periodontia.

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